TENTH ANNIVERSARY CONFERENCE

The Next Decade: New Challenges, New Opportunities

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Howard Community College • Columbia, Maryland

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COMPILED BY
TONY D. HAWKINS

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FORWARD

This volume represents the research, practice, and experience of conference presenters who chose to submit their papers for publication. AFACCT was proud to have so many outstanding presentations at this tenth anniversary conference.

This Conference was the result of the combined efforts of the AFACCT Board of Representatives who planned and participated in all aspects. Credit also goes to our colleagues and the Maryland Community College Vice Presidents and Deans for their continued support. The faculty and staff at Howard and Prince George's Community Colleges receive special thanks for their assistance and encouragement.

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PROCEEDINGS

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THE ACADEMIC WORKPLACE OF THE FUTURE[1]

Zelda F. Gamson
New England Resource Center for Higher Education
University of Massachusetts at Boston

I am delighted to be here as a guest of AFACCT. I want to thank Lois Newman and her colleagues for inviting me. As you know, I direct the New England Resource Center for Higher Education, which is dedicated to building community among college and university people. We run various workshops, conferences and ongoing groups we call think tanks. In all of these activities, we make sure we have representation from all the sectors in higher education and we always have faculty members and administrators from community colleges, and not just a token one or two.

If we want to change higher education, a precondition is the creation of community within our institutions and between institutions. It is especially important that college and university people speak to one another across sectors-- that people in liberal arts colleges know what is going on in research universities; that people in state colleges know what is happening in liberal arts colleges; that people in research universities know about life in two-year institutions. . And vice versa.

Why do I say this? First, it builds a sense of higher education as a whole we don't generally think about education, let alone higher education, as an industry. Yet it is, a very expensive and central industry in U.S. society. There are more than 3500 colleges and universities in this country, with total enrollments of close to 13 million students and expenditures of more than $100 billion. This is an industry, you'd better believe it!

It is an industry with tremendous variety, in which no category dominates numerically. Of the 3500 colleges and universities, 44% are public and 40% are two year. Schools in the public sector tend to be larger than private ones, with almost 80% of the students enrolled in public institutions (37% of the total enrollments are in two-year colleges, and most of them are in public community colleges). The student population is also quite diverse, and growing more diverse: 55% are women; 45% study part-time; more than 1/2 are over 25; close to 3/4 commute to school; more than 1/4 are in remedial writing and mathematics courses; 20% are members of a minority group.

At the same time, there is a dominant image of higher

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[1] Speech delivered at the 1994 conference of the Association of Faculty for Advancement of Community College Teaching.

education that does not match this reality. "College" still evokes the image of youth on the threshold of adulthood. (How many of my colleagues still refer to their students as "kids", even when most of the students in their own classes are in their late twenties and thirties!) These youth, in the traditional image, define their lives for a given period of time by a place called a "campus", where they spend most of their time studying and playing (Or should I say playing and studying? The accounts of student life from deans of students in one of our think tanks are hair-raising: partying that begins not on Friday, not even on Thursday, but on Wednesday and sometimes doesn't even stop after the weekend. Boozing to oblivion. Predatory sex.) In the image, at least, these students are motivated to partake of what the faculty has to offer them; even if they are not, they have what it takes to slide by. These students are, by and large, as the image goes, middle-class and white.

Yet we know that the reality is different. It is difficult, even for people who should know better, to revise this dream view of college, in part because it is unconscious, shaped by movies and tv, novels and biographies, which are produced by people whose own experience-- often many years ago-- were in the Busby Berkeley "fun" schools like Northwestern or UCLA or in the more academically serious schools like Harvard and Vassar.

But there is another reason that the image of "college" is so unconscious and inaccurate, and that reason is class, the word that strikes terror into the souls of most Americans. There is an academic pecking order that most people, despite some grumbling, accept. At the top are the seventy or so top-rated research universities. These universities have produced a substantial fraction of the current professoriate and recruit their own faculty from one another. They win the lion's share of grants and contracts and account for much of the publication in leading scholarly journals.

Close in prestige to the research universities are another 140 liberal arts colleges --Ivy League schools and other well-known colleges-- which draw their students nationally. This elite sector of research universities and well-known liberal arts colleges enrolls about 15% of the students studying in colleges and universities today.

On almost any other measure, the pecking order in higher education is accompanied by great inequality. From the point of view of a sociologist, higher education probably has about the greatest amount of inequality of any industry in this country. The average per-student expenditure in the 24 institutions where students' SAT's average 1225 or above, a good surrogate for institutional wealth, was $10,000 in the early 1980s. (It is now a good deal higher). In the 673 institutions where average SAT's were between 850 and 924, the average expenditure was $3800. In

private research universities, the average faculty salary in 1988 was close to $53,000, with an additional average income of $20,000 from consulting and their institutions; in public comprehensive universities in the same year, the average faculty salary was close to $37,000, with an additional average of $4500 from consulting and other earnings from the institution.

Why am I talking about these things? Because if we are to think about the academic workplace of the future, we must recognize, first, that criticisms and recommendations for change in higher education must be disaggregated for the different types of colleges and universities in the industry. With this general background about the higher education industry, I would like to turn to the forces that are occurring nationally and internationally their implications for higher education, then to the forces that are impinging on higher education directly, and then to community colleges specifically.

There are five national and international forces that have important implications for higher education: (1) technology, (2) the post-industrial economy (3) the global marketplace, (4) cultural diversity, (5) resources.

The growth of **computers and telecommunications** has created, under our noses in just the last few years, the capacity for individuals and organizations to transfer information across time and space. This means that businesses can operate across the globe, that people can complete their work outside of the usual organizational settings --at home, in the middle of the night-- and that the speed of communication is faster than the human brain or physical organism can absorb easily.

The shift toward a **post-industrial economy** preceded, but has been accelerated, by the growth of computer-based technologies. Manufacturing industries, such as steel, automobiles, and mining have been in decline for several decades. So-called service industries, such as finance and health care, have been in ascendance. Average earnings in the service sector are lower, especially for those with limited education, than in the manufacturing sector, with fateful results for whole communities, for families and for individuals.

The development of a **global marketplace** is closely related to the technology revolution. With the fall of the communist countries, and the rapid economic development in east asia, the economic dominance of the u.S. Is up for grabs. Whatever the outcome, it is clear that the united states will no longer be the economic giant it was in the 1950s and 1960s.

Increasing cultural diversity derives in part from immigration to this country from the countries whose people are fleeing political persecution, instability, and poverty, as well

as from a higher birth rate among people of color.

Limited and unequally distributed resources among nations and individuals is on the increase, for a variety of reasons: the resources needed to operate in a global marketplace are expensive; the shift from manufacturing to service jobs brings unemployment and low wages; immigration forces people to start at the bottom; tax policies favor global corporations and the wealthy. These forces, and more, limit the resources nations, states and individuals have available for goods and services.

The implications for higher education of these social and economic forces are, I believe, driving the pressures on colleges and universities to change. I have been in the higher education business since the middle 1960s, and there hasn't been a time that higher education hasn't been asked to change. In the late 1950s, the launching of sputnik stimulated a lot of attention to education at all levels, especially in math and science. In the 1960s, an expanding economy and great optimism spurred enormous investment in higher education; this was the decade when community colleges came into their own. The 1970s brought a concern with accountability and results, the 1980s attention to undergraduate education and diversity, and the 1990s --well, we're in it now and it's hard to know. But I think we are back to accountability with a vengeance.

Pressures for change have accelerated with the rate of general social change and with the greater visibility of higher education. In 1970, 14% of the labor force age 25-64 had college degrees; today, more than one-quarter do. When only a small fraction of the population had a college education, colleges and universities were distant, intimidating places. With an industry when almost anyone can go to some college, higher education has become just another industry, still respected but no longer immune from scrutiny. As one of the central sectors of the society, more central with the general social forces I have described, higher education comes in for some heavy ragging in the media. Note the tremendous attention to the issue of political correctness in the last few years, an issue that is almost non-existent on the vast majority of campuses.

There is another reason that higher education is getting more visibility, and that is because of the growth of what I would call a higher education change industry. This change industry includes foundations and federal agencies that fund projects for change, such as the Fund for the Improvement of Postsecondary Education and private foundations like Ford and Pew. The number of foundations and the dollars spent on higher education have grown dramatically in the last thirty years. Foundations which once would only support projects in wealthy, famous colleges and universities now feel that they should help

state colleges, local private colleges, and community colleges.

There are industry media, most especially The Chronicle of Higher Education, that have been around for no more than 25 years. Higher education has become a field of study, with its doctoral programs, associations, and journals. Disciplinary associations and general higher education organizations, such as the one I direct, have either been founded in the last decade or two or expanded rapidly.

Issues about the academic workplace have been raised in these circles in the last several years. The question of faculty productivity --how to get faculty to teach more and better, how to help them provide technical expertise and professional service to communities-- fuel discussions of new definitions of scholarship and of new faculty roles and rewards that would assess and reward teaching and professional service more systematically, an issue my colleagues and I have been working on. Issues of restructuring --how to make better use of institutional resources through eliminating and recombining departments and creating new ones in response to current needs-- have been discussed in a variety of circles and publications. Process concerns, such as TQM, continuous quality improvement, team-building, strengthening the department as a collective unit, and learning communities-- have all been ideas in circulation for several years. And elements of really radical ideas, such as using technology and far-flung learning centers that are not geographically based, have been around in programs for adult learners for several years.

There are several voices that are missing from these discussions of academic organization. The voices of students and organizations representing them are notably absent. As they have been from every educational change campaign since the late 1960s. More surprisingly, the voices of faculty are missing. These are discussions among administrators and policy-makers and the organizations that represent them. The disciplinary associations have not entered the picture in any way except, on occasion, to defend threatened departments and faculty members. Faculty unions are active, but primarily to prevent job loss in cases of lay-offs.

Another missing voice is that of community colleges, where many of the changes that are being suggested are to be found. Thinking of opening up learning opportunities off-campus near where people work and live, take a look at community colleges. Looking for interdisciplinary departments and new departments responsive to external needs? Check out community colleges, where the disciplines are combined differently than they are typically in four-year institutions, even small colleges that can only afford a couple of people in a department. Interested in getting faculty to teach more, make use of technology, respond to

a diverse student body? Take a good look at community colleges. Want to make colleges and universities more responsive to needs in the society and faculty available for professional service, you will find that community colleges and their faculties are doing it already.

It is time that community colleges get participate in the discourse about the future academic workplace. This means making presentations at conferences, writing for publications like **Change** and **The Chronicle of Higher Education** and getting grants from foundations. Here are some of the things I would emphasize:

1. **New organizational structures:** Community colleges have experience with structures that are unfamiliar at four-year institutions, such as inter-disciplinary divisions, off-campus learning centers, and worksite classes.

2. **Faculty roles:** Community college faculty are experienced teachers who have developed great sophistication about the use of different learning approaches. Some faculty in community colleges provide technical assistance and community service. Because so many faculty in community colleges are part-time while pursuing another profession, community colleges have something to teach about how to incorporate practitioners into the ongoing life of an institution.

3. **Adults as learners:** We are all aware of the demographic projections which show that there will be even more adujlts in our colleges and universities in the years to come than there are now. Community colleges have a lot to teach other institutions about the use of telecommunications and computers, distance learning, scheduling, and techniques for teaching adult learners.

4. **Student diversity:** By virtue of their accessibility, community colleges have a track record in the education of racial minorities and disadvantaged students. Along with urban four-year institutions, community colleges have learned what it means to live with --indeed, celebrate-- diversity among their students. If anything, they will be asked to do more with immigrants and disadvantaged urban people, a growing sector of our population. They will have to work actively, as many of them now do, with public schools to help stem the shockingly high drop-out rate. They will need to work with school committees, with principals, with teachers and most of all with students to nurture them early so that they have a fair chance to enter and complete a higher education.

5. **Redefine quality:** Community colleges are often put on the defensive by the issue of quality. Rather than fight over performance on the traditional measures of quality --which are often based on or highly correlated with library holdings, SAT scores of incoming students, and number of faculty publications--

community colleges should proudly show off how well their graduates are doing compared to where they began. They should brag about how much their faculty have helped solve local problems-- and reward them for doing so. They should calculate how much they contribute to the economy of their area through their graduates, their professional services, and their employees.

6. **Contribute to the quality of public life:** This is more a hope than a reality. It is safer to focus on the economic benefits of higher education than on its contributions to the quality of public life. Yet it seems especially necessary in the light of the cataclysmic events in the formerly Communist countries, where ordinary citizens demonstrate their yearning for democracy. In contrast, we have become spectatiors in our own republic. We need more institutions to be actively engaged in the democratic project. Community colleges, because they are located in the most densely populated and most influential centers of this country, can become a powerful force for improving the quality of public life. They can become places for tackling environmental problems. With their programs in human services, they can try to do something about the degradation of families and children in this society. In doing so, they would be demonstrating to other colleges and universities a renewed vision of education for democracy and social responsibility.

This is the challenge for the academic workplace of the future. Are we up to it? If we occasionally lose heart, let us remind ourselves of something the great british historian , Eric Hobsbawm, said in a lecture this fall at the opening of the Central European University in Budapest:

> Governments, the economy, schools, everything in society, are not for the benefit of the privileged minorities. We can look after ourselves. It is for the benefit of the ordinary run of people...It is for the people who, throughout history, have entered history outside their neighborhoods as individuals only in the records of their births, marriages, and deaths. Any society worth living in is one designed for them. (**New York Review of Books**, December 16, 1993.)

Thank you very much!

"I HEAR YOU KNOCKING BUT YOU CAN'T COME IN"
Keynote Address to AFACCT's Tenth Anniversary

Brunetta R. Wolfman, Ph.D.

I would like to than Dr. Lois Neuman and the Planning Committee for inviting me to speak, and I want to congratulate you on your tenth anniversary. This is a rather remarkable accomplishment for an organization dedicated to faculty development to persist for such a period of time. I am impressed that you have not splintered into ten different groups in that period time as so many groups do, in that uniquely American way.

I suggested the title after reading the continually dismal news about the fiscal crisis and its effects on the community colleges. So, I think that we should consider if those words from the old song are going to be the theme song of the community colleges in the next decade. Frequent news articles discuss the increasingly desperate financial status of the colleges, the increased need for remedial courses and the rising cost of tuition at both public and private colleges. Will the shape of the community colleges change as they become more exclusionary and the four year colleges become more inclusive in their search for student bodies? Will there be a need to reinvent the community colleges in order to meet the needs of a reconfigured population? Will those persons knocking go away or will they knock down the door or come through the windows? And what does this have to do with you?

Are you affected by the continual news reports of funding cuts or drops in enrollments? The latest American Council on

Education report show a 7.8% enrollment decline, primarily in community colleges, and **The Chronicle of Higher Education** reports that there was a 9% drop in California community college students partially attributed to the reduction in the number of courses and classes and early faculty retirements. We also hear the constant refrain that students of color are concentrated in two year colleges as if it is a bad thing; since lower status is associated with people of color, then community colleges are considered lower status institutions. However even though more students of color are in two year colleges, the percentage of degrees earned by those students remained flat for the five year period from 1985-1990. Thus, the enrollments and graduation rates for students of color did not keep pace with the increases in those groups in the general population.

Every headline about fiscal cuts, fewer classes, higher tuitions, tighter admissions standards act as deterrents to many students and families, depressing their aspirations and making them think that college is an impossible dream. Should we accept these dire predictions and change the way in which we think about community colleges? NO! We need to tell the press and the public about the colleges, what happens to people who attend and what promise the colleges offer.

Let's take another look at the community colleges by reviewing a study entitled, **The Way We Are: The Community College as American Thermometer**, by Clifford Adelman of the U.S. Department of Education Office of Research; he examined data from the

longitudinal study of the high school class of 1972 and found that one out of four graduates earned at least one credit from a community college over a twelve year period. He also found that the graduates accommodated learning on their own terms and in their own time in that they did not know much about the Associate degree or necessarily plan to obtain one. However, twenty percent of the class earned the A.A. in over twelve years, but most of them were interested in testing their tolerance for higher education and learning job skills than in obtaining a degree. They were representative of the Class of 1972, very average, moderate socio-economic backgrounds and mid-ranks of their high school classes but more representative of the general population in terms of percentages of minority students. Dr. Adelman found that earning an A.A. or B.A. still made a difference in job status and salaries. There were a higher percentage of community college graduates in professional jobs than those who did not complete the Bachelor's degree, and "some patterns of community college attendance were associated with higher earnings and rates of home ownership than other patterns of postsecondary attendance." However, four year college attendance and study is the still the most consistent factor in economic mobility.

In 1982, I did not know much about these research findings when I decided to run for the presidency of Roxbury Community College. My husband and I planned a campaign whereby I sought the support of Boston's opinion makers before the formal search process began. It was not that I knew much about community

colleges, having only a romanticized view of California's glory days of community college growth, but I had a personal conviction about the educational opportunities which should have been available to Boston's inner city populations. I also had to fulfill a family obligation to service and as my Mother would say, to do something for the "Race."

Roxbury was intended to be a throw away college, a sop to Black and Latino activists who demanded a college for their community, but I understood the aspirations of the students, most of whom were poor women. I understood the hopes of the faculty, an ethnically and racially diverse group of very bright people willing to sacrifice career possibilities to work in Roxbury. It was those two groups along with the ambitions of community people who wanted greater educational opportunities that made me want to make a difference. I also knew that many of the staff were inadequate to the job and bogged down in marginality and set low standards for the College and their peers, to the chagrin of those staff who wanted to be committed to excellence. The Trustees were unlike those at other public colleges and had little idea of their role or that of the president.

I went to the job of President with the objectives of building a new campus, helping faculty create a viable academic program and curriculum, gain reaccreditation from the New England Association of Schools and Colleges, and raise scholarship funds. We accomplished those objectives by establishing partnerships with neighboring colleges and universities, becoming partners

with the business and corporate community which contributed equipment and scholarships and provided internships and jobs for graduates. We developed a respectable administrative structure by redefining responsibilities, hiring new staff and giving them decision making authority through team building and collaborative management. We gave the students, faculty and community a larger vision; we used the accreditation process to re-examine the College and involve the faculty in that process; we got foundation and government grants to help the faculty improve their teaching and to give them time to become involved with their profession.

I learned a great deal about the obstacles to change, especially marginality which fosters narrow Black Nationalism, self-hatred and group self-hatred, thugism and nihilism, so encouraged by popular culture. I also learned a great deal about politics, the politics of political ambition, of personal ambition and of the ways in which the media can be corrupted by these politics and ambitions. I had been raised to be a "good girl" so that I was unprepared to fight the behaviors associated with those ambitions and marginality.

We worked hard to turn those negatives to positives by using cultural activities to create an environment which enhanced everyone's culture, encouraging sharing and understanding. We worked hard to encourage excellence and to set standards to achieve excellence. Our activities strengthened the families off our students by developing a model child care center and teaching

parenting skills, by teaching them how to become advocates for their children's schooling, by letting them be role models for their children as they became serious students, by teaching them how to handle physical and emotional abuse, by helping them create a structure for their lives and set goals for the future.

I became a true believer in community colleges even though I had started with other motives. I became a true believer because I saw the development of the educational potential of people who had been educationally abused. I experienced the way in which an organization can change and enhance the development of learning and creation of an environment for learning. I experienced the joy of cooperative collaborative management, the sharing of problem solving and problems. I truly believe that community colleges can provide a model for all of higher education.

None of us can be quiet about what the community colleges are doing and what they can do. You must tell the higher education world and the public what you are doing and what your students are accomplishing. What you are doing makes sense for today and for the next decade.

I will close with a quotation from an essay on dreams by Howard Thurman, from **The Inward Journey**,:

"Our dreams must be saddled by the hard facts of our world before we ride them off among the stars. Thus, they become for us the bearers of the new possibility, the enlarged horizon, the great hope. Even as they romp among the stars they come back to a place in our lives, bringing with them the radiance of the far

heights, the lofty regions, and giving to all our days the lift and magic of the stars."

Thank you.

Trends for the Next Decade: Implications and Opportunities

presented by Dr. Arthur W. Chickering

Professor, George Mason University
Graduate School of Education

Dr. Chickering presented four major trends that he sees in the coming years, the implications for higher education in community colleges, and the opportunities they will present.

TRENDS AND CHALLENGES

Diversity

Horizontal: National Origin, Race, Ethnicity, Socio Economic Status
Vertical: Adolescents, Young Adults, Active Professionals, Career Changers, Pre-retirees, Retired persons
Learning Styles

GENDER

Transnationalism/Global Interdependence

Western/Eastern
North/South
"Developed"/Third World

TRENDS AND CHALLENGES

Accountability

Benefits vs. Costs
Outcomes vs. Inputs
Gains vs. Status

Information and Communication Technologies

NREN (National Research & Education Network)
Direct Access Via Digitized TV/Computers
Local, National, International

IMPLICATIONS AND OPPORTUNITIES
Learners and Learning

Empowering Lifelong Learners

Clarifying Purposes/Objectives
Clarifying Processes
- Cognitive Processes: Knowledge acquisition, Analysis, Synthesis, Application, Evaluation
- Learning Processes: Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation

Identifying and Selecting Resources
Defining Products/Performances
Evaluating Outcomes/Progress

Individualized Learning

Content: Degree programs, Certification, Learning Contracts/Plans
Process: Cognitive and Learning Processes

IMPLICATIONS AND OPPORTUNITIES
Learners and Learning

Multicultural Learning

Content: Languages, Literature, Theatre, Arts, Anthropology, History ---
Process: Collaborative Projects; Volunteer Services; Work and Learn; Travel; Immersion

Technology Assisted Learning

Accessing Resources: Print, Pictures, Persons, Interactive Programs
Creating Networks: Learning, Support
Generating Products/Performances
Affective Power

IMPLICATIONS AND OPPORTUNITIES
Institutions

Emphasis Shifts From Inputs and Processes to Outcomes and Gains

- Credit for Contact is Obsolete

Focus Shifts from Teaching to Learning

- Teaching=Creating the Conditions for Learning

Faculty Roles Shift from Designing Curricula, Course Syllabi, and Teaching Content to:

- Teaching Learners How to Learn
- Coaching Learners and Facilitating Learning
- Supplying Expertise and Critical Judgements Re. Resources for Learning
- Supplying Expertise Re. Learner Self Evaluation
- Establishing Outcome Criteria for Degrees and Certificates
- Exercising Quality Assurance Re. All Learning Under Institutional Aegis

Faculty Composition Diversifies

- Full-time Core
  - Active Scholars
  - Practitioner Professionals
- Long Term Part Time
  - Diverse Roles and Responsibilities
- Ad Hoc or Short Term Tutors

IMPLICATIONS AND OPPORTUNITIES
Institutions

Institutional Differentiation

Theory Oriented Research Universities and Institutes
Applied Research Universities and Institutes
Universities, Colleges, and Community Colleges
- Responding to State, Regional, and Local Needs
- Linking Theory and Practice, Scholarship and Application
- Emphasizing Learners and Learning

Professional Development re:

New Faculty Roles
Use of Information and Communication Technologies
Flat, Loosely Coupled, Administration
Continuous Quality Improvement
Institutional Flexibility and Change

KEY QUESTIONS FOR COMMUNITY COLLEGES

How Well Prepared Are Community Colleges To:

Empower Lifelong Learners?
Enable Individualized Learning?
Encourage Multi-cultural Learning?
Assist Learning Through Communication and Information Technologies?

How Ready Are Community Colleges To:

Emphasize Outcomes and Gains?
Shift Focus from Teaching to Learning?
Move Toward New Faculty Roles and Composition?
Create a Clearly Differentiated Institutional Mission?
Undertake Necessary Professional Development for Administrators and Faculty?

USING ACTIVE LEARNING TO TEACH

James Bell

Abstract

This workshop provided evidence that students learn more when they are active. A variety of active learning techniques were modeled and participants shared active learning techniques they were using.

Some Active Learning Techniques

Think-pair-share.

Pair learning.

Taking surveys in class.

Tandem testing (pairs or groups taking tests together)

Leaderless small groups

Brainstorming

Simulations and Games

Ideas for increasing student involvement during lecture

Adding in short written assignments during class

Using ideas from Classroom Research

Developing and using Answer Keys (a part of compare and contrast)

Teaching students to count squares and rectangles.

Some Ideas To Improve Learning

Provide written instructions rather than oral instructions
- Increase the specifics and add example answers

Provide written film guides
Use oral quizzes
Increase the emphasis on application
- In related aspects of the course
- To other courses

Increase the teaching of thinking skills
Increase feedback during class and on homework.
- Use peers
- Develop check lists for instructor to use

Increase positive reinforcement in the classroom.
Teach students to do compare and contrast
Encourage written work to be revised

GETTING STUDENTS TO ACTIVELY LEARN: AN EXAMPLE FROM THE FIRST CLASS OF GENERAL PSYCHOLOGY AT HOWARD COMMUNITY COLLEGE

Is the first class the most important of the entire course? My thinking is that the first class is at least one of the most important. Consequently, I have developed a variety of active experiences for students.

GOALS FOR THE FIRST CLASS:

1. Provide an environment that supports learning.
2. Provide a stimulating introduction to the course.
3. Provide information about myself to the class.
4. Provide students the change to get to know each other.
5. Provide practice in doing a homework assignment.
6. Provide activities that will engage the attention of the class and be useful to refer to during the course.

SEQUENCE OF ACTIVITIES:

1. When students enter the class, they find the following:
   a. Music is playing.
   b. A slide is showing on the front wall.
   c. The name of the course, my name, and "Welcome" is on the board.
   d. A note on the board requests students to fill out a gold Data Sheet which is on each seat.

2. To start the class I ask students to count individually the squares on a large poster board that I hold. After a minute I suggest that they should take a second look. After another minute I ask students to share their counting in pairs. I then ask the class how to count the squares (there are 30). I indicate that in this course we will be taking a second, deeper look at psychology for we all live in a psychological environment.

3. To decrease the anxiety of being in a new situation and knowing few classmates, I ask students to divide into pairs and pretend they are reporters for a newspaper who need to find some interesting information about their partner. They interview their partner for 3 minutes and then the partner does the interviewing. Then two pairs join and introduce their partners to the new pair.

4. The course is introduced through 4 slides (students are asked to comment on each slide): a slide that can be viewed in two different ways, an ambiguous slide which shows that what we bring to a psychology class differs, a slide which is tough to see (a cow) but becomes clear with help - I have two posters which pinpoint the cow, and a slide which takes a little time to read and says "choose". This slide is used to introduce the idea that previous students helped plan the course and that during the course students have choices. While talking about the slides, I weave in personal information to let students know who I am.

5. The Assignment Sheet is then reviewed along with a brief overview of the course, the course goals, the course handouts, and the textbook. The Assignment Sheets list all of the homework assignments along with all of the major class activities. A one page guide to understand the Assignment Sheets is provided in case students are too anxious to listen carefully. I stress the idea that effective learning takes time. Students then share in pairs their first reactions to the course.

6. After collecting the gold Data Sheet I talk to any students who do not have the correct prerequisites and any students who look like they are trying to do too much (Students who are taking a full college load and working more than 20 hours weekly.). By talking with them during the first class I am able to help them either decide to stay in the class with the knowledge that they will have to work extra hard or help them get into a better course for them.

7. Students are asked to read notes from the first lecture (a written lecture, not oral) which introduces the field of psychology and includes a practice assignment similar to homework assignments. A work sheet is placed on the front desk for students to pick up when ready, fill out, and then on the back are answers to check the work. If students have a problem, I talk with them individually when they return the worksheet to me at the end of class.

8. At the end of the first class students are asked to write their reactions to the introduction of the course: "What are your reactions to the slides and verbal introduction given to this course?".

9. I remain after class to answer individual questions.

10. If a student misses the first class, I have put together a guide sheet which takes them through the necessary information (written) except for the slides.

FEEDBACK FROM PARTICIPANTS

In what ways might even more active learning be included? Here are some ideas suggested by participants of the workshop:

1. Provide a change for students to discuss in small groups any potential problems they anticipate with the course.
2. Ask students to fill in a schedule for the previous week and then indicate what will be dropped to provide time for college learning.
3. With small classes have students introduce themselves to the full class.
4. Do a survey of the class. Ask for a show of hands according to majors, number of earned college credits, hours of work, and long term goals.

EXAMPLE CHANGES I HAVE MADE IN MY TEACHING TO GET STUDENTS TO BE MORE ACTIVE AND THINK MORE

INCREASING STUDENT THINKING: SCANNING

I. Previous Teaching
   A. GOAL: To tell students about the course textbook.

   B. METHOD: I noted the title and the authors, briefly listed the major topics of the book and the major divisions of the text. I assumed that students would scan on their own and that they knew how to scan. False assumption!

II. Current Teaching
   A. GOAL: To scan the textbook for 20 minutes (homework) and write what you learned about your textbook. (A problem to solve - Given a limited time, what are the most important things to look for?)

   B. METHOD: I have found that students learn more if they look for themselves and they learn to be less dependent on me. "Scan for 20 minutes your textbook to see what you can learn about this textbook. Write down what you learned."

   C. Result: Few students know how to scan efficiently. Since this is the first homework assignment, I provide a feedback sheet to expand their thinking about scanning.

INCREASING STUDENT THINKING: DEFINING SOCIAL PSYCHOLOGY

I. Previous Teaching
   A. GOAL: To recall the definition of social psychology as stated in their textbook.

   B. METHOD: Students read the first chapter in the social psychology textbook and wrote down the definition of social psychology. Now they know how to define social psychology!

II. Current Teaching
   A. GOAL: To synthesize their own definition of social psychology after studying a number of different definitions.

   B. METHOD:
      1. Ask students to write down their definitions of social psychology without reference to any source.
      2. Ask student working alone to brainstorm where they might look to find out how to define social psychology.
      3. Asks groups to brainstorm where to look.
      4. Ask each student to find relevant information in their textbook.
      5. Provide 2 pages of definitions from a variety of textbooks in social psychology. Ask students to compare and contrast the definitions.

6. Ask students to identify the elements of the thinking process of compare and contrast.
7. Provide a sheet which discusses how to compare and contrast.
8. Provide an example of compare and contrast using a few of the definitions.
9. Ask students to write their synthesis definition of social psychology.

C. Result: Students learn to find information for themselves, to compare and contrast, to synthesize a definition, and to understand that sources differ.

INCREASING STUDENT THINKING: ANALYZING TELEVISION

I. Previous Teaching
   A. Goal: Recall the facts about the effects of television after reading about TV and the effects.

   B. METHOD: Students read and studied an article on the facts about the effects of television.

II. Current Teaching
   A. GOAL: To analyze violence on television and write a report.

   B. METHOD:
      1. Students read an article on the effects of TV.
      2. Students read a handout on defining aggression and prosocial behavior.
      3. Students participate in a class activity on learning to use a chart to observe aggression and prosocial behavior on TV by watching and analyzing 3 cartoons.
      4. Students observe 20 minutes of 3 different types of TV programs and record their observations of aggression and prosocial behavior.
      5. Students write a report on what they observed and indicate what they think children would learn from the programs they watched, what they learned about television, and what they learned about doing research.

   C. **Result:** Students become aware of the large amount of violence on TV which they had ignored in the past. They get practice in observing and thinking like a psychologist.

On the next page are the steps I use when adding new thinking assignments to my courses.

HOW DO I PERSONALLY TEACH THINKING SKILLS?

As I add in additional thinking skills to my courses, I find that I start with Method 1 which usually does not work. Very quickly I move through Methods 2, 3, and 4. Method 5 is what I have found that I need for almost all assignments that involve new thinking skills.

Method 1 Assign and grade.

I make an assignment and give students no further instructions.

EXAMPLE:

"Critically evaluate this short article."

Results:

a. If students can do the assignment without further help, I do not change the assignment. Very rare occurrence.
b. If students can't do the assignment, I move to Method 2.

Method 2 Assign and provide criteria.

I add the criteria I will use to grade the assignment.

EXAMPLE:

"Critically evaluate this short article. Identify the scientific evidence and the nonscientific evidence. Label the three parts of each psychological fact (the scientific evidence).

Results:

a. Students who have previously learned to critically evaluate show improvement when they know the criteria.
b. Students who have not learned to critically evaluate are unable to identify the psychological facts and the three parts.

Method 3 Assign, provide criteria, and provide an example.

To guide student thinking and learning I provide an example of a good answer.

EXAMPLE:

One psychological fact is identified and the three parts are labelled.

Result:

Examples usually help but only for simple types of thinking. More complicated types with just the answer don't seem to help much. Identifying one psychological fact does not seem to help very many students.

Method 4 Assign, provide criteria, provide an example, and add in hints.

The hints are based on difficulties of previous students. If students forget to do an aspect of critical evaluation, then the hint reminds them to do that step. Hints are written down since verbal hints are missed by too many students.

EXAMPLE:

"Previous students often overlooked the criteria of listing all the sentences that are a part of a psychological fact."

Result:

Hints provide some increased learning but are usually not very helpful until students have learned a skill and need reminding of the criteria.

Method 5 Assign, provide criteria, provide an example, add in hints, and provide practice.

Practice can involve the whole skill (identify psychological facts) or doing parts of the skill (identifying citations, research results, and then later the description of the study).
If the first practice is on only part of the skill, later practice will need to be on the entire skill.

EXAMPLE:

To teach students to identify scientific evidence I do the following:

Ask students to identify the 3 parts of a psychological fact: citation, description of the study, and the research results. This involves explaining the importance of being able to identify a psychological facts and explaining what each of the 3 parts means.

Ask students to identify psychological facts in several different sources at first in groups and then alone.

Model how to identify psychological facts.

Provide opportunity for questions and answers.

Provide feedback to students.

Build into several assignments the need to identify psychological facts.

Result:

Most students learn to identify psychological facts. Some pick up the skill quickly whereas others need several sessions of practice and feedback.

Method 6 Add to method 5 mastery learning.

If students are not successful the first time on an assignment, they are asked to redo the assignment until they can show they have learned.

EXAMPLE:

"Your answer does not show you have learned to critically evaluate. Redo the section on identifying psychological facts. Restudy your text on identifying psychological facts."

Result:

Almost all of my students are able to critically evaluate by the end of the course. About 5% are not able due to having missed several key classes and for reasons I have not yet figured out.

Method 7 Assign without criteria, hints or examples.

Can students identify psychological facts without being told when asked to critically evaluate? Here I am looking for application (transfer of learning).

EXAMPLE:

"Write down your thoughts about this article." Note that I have not indicated that critical thinking is what I am looking for.

Result:

Students don't apply as often as I would like. I probably need to give more practice.

Method 8 Observe whether students identify psychological facts in situations outside of my classroom.

During discussions do students cite relevant psychological facts? Do students cite psychological facts when writing papers where there is no explicit requirement of psychological facts? Do students ask the instructor to provide psychological facts to back up conclusions?

EXAMPLE:

"In Speech class I had to give a speech on the effects of TV. I was able to find several psychological facts when made my position stronger."

Result:

Transfer to other courses does occur. How often? I do not know. I do not have an unbiased method of checking. I do know that in my upper level classes that the appropriate use of psychological facts is much lower than I desire.

Dr. James Bell, Professor of Psychology
Howard Community College
Columbia, MD 21044
410 - 992-4892 - office
410 - 730-5311 - home

VISUAL THINKING IN MATHEMATICS

Eldon C. Baldwin

Abstract

Prior to the recent evolution of computer and calculator technology, careful and accurate graphing of mathematical functions was a slow and tedious process. Consequently, undergraduate mathematics instructors tended to demonstrate graphing techniques and assign graphing exercises infrequently. As a result, many students failed to develop strong graphing and important visual thinking skills. While practicing mathematicians routinely employ visual thinking in their own problem activities, undergraduate mathematics teachers frequently emphasize abstract symbolic problem solving techniques, while neglecting more general visual techniques in problem interpretation and solution.

Computer technology has also enabled research scientists and mathematicians to study problems which were previously considered too complex. Studies in such seemingly diverse topics as turbulence in fluids, long range weather forecasting, asteroids orbiting the sun, and cardiac fibrillations have uncovered new mathematical concepts, and have contributed to developments in the new fields of mathematics research: Chaotic Dynamics and Fractal Geometry. Some predict that these discoveries will be as important to mathematicians in the 21st century as differential equations have been to mathematicians in this century.

Maryland Undergraduate Mathematics Enhancement Program

In 1993, the National Science Foundation approved grant funding for the Maryland Undergraduate Mathematics Enhancement Program (MUMEP). Since then, MUMEP has formed a regional coalition of college and university undergraduate mathematics faculty in the Baltimore-Washington area, and has started conducting the a two-year

faculty enhancement program entitled *Visual Thinking in Mathematics: The Impact of Technology*. The MUMEP coalition is co-directed by Dr. Eldon C. Baldwin, Prince George's Community College, Dr. Denny Gulick, University of Maryland at College Park, and Mr. Jon Scott, Montgomery College Takoma Park. The broad goals of MUMEP are to: 1) Present new visual mathematical topics to faculty from the coalition institutions, 2) introduce concepts of visual thinking in mathematics to these faculty, 3) relate these new visual mathematics topics to existing undergraduate mathematics courses, 4) encourage mathematics faculty to include both visual topics and visual pedagogy in the courses they teach, and 5) promote communication, coordination, and collaboration among coalition institutions.

Summer Workshops The initial MUMEP activity was a six-day workshop for 40 participants during the summer of 1993 at Prince George's Community College. This first workshop was entitled *Visual Thinking in Chaotic Dynamics*. Follow-up seminars are being conducted during the 1993-1994 academic year. The summer 1993 workshop was highly successful, and there is a proposal pending for additional NSF funding so that the *Visual Thinking in Chaotic Dynamics* workshop can be offered again during summer 1994. In addition, a second workshop and seminar series entitled *Visual Thinking and Fractal Geometry* is already approved for the summer of 1994 and the 1994-1995 academic year.

Why Visual Thinking?

In 1991 the Mathematics Association of America published a book entitled *Visualization in Teaching and Learning Mathematics*. In their introduction to the book, editors Walter Zimmermann and Steve Cunningham[1] describe visualization in mathematics as "the ability to draw an appropriate diagram (with pencil and paper, or in some cases, with a computer) to represent a mathematical concept or problem and to use the diagram to achieve understanding." They also note that "the sciences, engineering, and to a more limited extent mathematics, are enjoying a renaissance of interest in visualization."

The growth and development of technological tools such as computer graphics hardware and software are primarily responsible for this renaissance of visualization. "Properly designed computer-supported environments can provide, through their concreteness, a scaffold for reasoning and a matrix for problem posing and can foster the development and use of qualitative, visually based reasoning styles to augment the traditionally taught symbolic-deductive methods," says E. Paul Goldenberg[2] of the Educational Development Center in Newton, Massachusetts. Whereas most college and university mathematics departments are gaining increased access to computers, we believe that few undergraduate mathematics programs today would meet Goldenberg's criteria for providing "properly designed computer-supported" learning environments.

It is also important to understand that visualization in modern mathematics involves much more than simply producing graphs and diagrams on computer screens. It involves the use of such diagrams to achieve better understanding of abstract mathematical constructs and concepts. Thus the use of visualization in mathematics education holds the potential of enhancing student understanding and appreciation of mathematical ideas. Distinct from the notion of "producing visual information," we will use the term

"visual thinking" when we want to focus on "processing visual information" to achieve understanding of a problem or concept.

Philip J. Davis and James A. Anderson[3] suggest that "mathematics has elements that are spatial, kinesthetic, elements that are arithmetic or algebraic, elements that are verbal, programmatic. It has elements that are logical, didactic and elements that are intuitive, or even counter-intuitive." Because of the way in which mathematics is traditionally taught, most students believe that mathematics is primarily arithmetic or algebraic as opposed to geometric or visual. Placing greater emphasis on visual thinking can play an important role in achieving a balance between algebraic and geometric reasoning in mathematics. Zimmermann and Cunningham[1] describe three specific areas of mathematics education in which visualization can make major contributions:

> **Study of Patterns** A major purpose of education is to facilitate recognition, explanation, and understanding of patterns. Lynn Steen[4] describes mathematics as "the science of patterns." The mathematician tries to recognize patterns hitherto unknown, and to explain patterns once they are recognized. Of course, as Davis and Anderson point out in [3], "not all patterns can be visualized, but it is as natural to want to visualize a pattern as it is to want to hear a melody. If mathematics is the science of patterns, it is natural to try to find the most effective ways to visualize these patterns and to learn to use visualization creatively as a tool for understanding."
>
> **Understanding Concepts and Problems** Mathematical visualization serves an important role in problem solving. Davis and Anderson[3] distinguish between visualizing a diagram and visualizing a concept or problem. "To visualize a diagram means to simply form a mental image of the diagram, but to visualize a problem means to understand the problem in terms of a diagram or visual image." Visualizing the problem is what we have termed "visual thinking."
>
> **Building Intuition** Mathematical visualization and mathematical intuition are inextricably linked. Davis and Anderson[3] support this claim, suggesting that mathematical visualization involves "intuition through pictures formed in the mind's eye." This aspect of visualization goes beyond the mere recall of pictures previously viewed, to the creation of mental images which may have never been viewed before. The authors assert that "the intuition which mathematical visualization seeks is not a vague kind of intuition ... , but the kind of intuition which penetrates to the heart of an idea. It gives depth and meaning to understanding, serves as a reliable guide to problem solving, and inspires creative discoveries."

Visual Thinking and Pedagogy

Significance According to Theodore Eisenberg and Tommy Dreyfus in their article "On the Reluctance to Visualize in Mathematics"[5], there is a general preference on the part of students to think about mathematics in algebraic and symbolic rather than visual ways. The authors cite several reasons for this perceived preference:

Visual thinking is not "real" mathematics Eisenberg and Dreyfus contend that most mathematicians, teachers, and students believe that visual mathematics is not "real" mathematics, and that proofs are only complete when supported by solid symbolic representations.

Symbolic teaching is more efficient According to Eisenberg and Dreyfus[5], mathematicians are more likely to consider the visual element of a problem in their own work than they are to focus on the visual aspects of a problem when they teach it. In trying to understand a problem, mathematicians frequently use diagrams and pictures that depict the many relationships which exist among individual components of the problem. When a mathematical topic is taught, however, it is common practice to break the subject into isolated "bits" of knowledge and skills, and to then teach those "bits" in a sequential manner. The result is that many of the relationships in the subject which can be explicitly visualized are reduced to implicit relationships when represented sequentially.

This sequential approach to teaching mathematics leads quite naturally to an algorithmic approach to problem solving. As a result, many students learn and apply algorithms to solve problems, and thereby arrive at "correct" solutions without ever really understanding what the problem is all about. Eisenberg and Dreyfus[5] conclude that most mathematics is taught in a sequential, linear fashion because it is more efficient to teach that way, and thus it is only natural that students prefer this more abstract approach to problem solving over more intuitive visual procedures.

Visual thinking is harder to teach Eisenberg and Dreyfus also say that visual methods are cognitively more difficult to teach and to employ than are algorithmic methods. A picture can convey a great deal of information, but one must be able to interpret that picture in order to access the information it contains. In essence, one must understand a problem in order to either construct or interpret a diagram or figure related to that problem.

In their introduction to *Visualization in Teaching and Learning Mathematics*, Zimmermann and Cunningham[1] link visualization to recognition of patterns, understanding of concepts and problems, and development of intuition. But in spite of the fact that many mathematicians rely heavily upon visualization in their own work, Eisenberg and Dreyfus[5] find that mathematics teachers and students frequently do not develop and use visual thinking skills. Influenced by these findings by Eisenberg and Dreyfus[5], and Zimmermann and Cunningham[1], we have concluded that the pedagogical aspects of visualization in general and visual thinking in particular are of great significance to the enhancement of undergraduate mathematics teaching and learning.

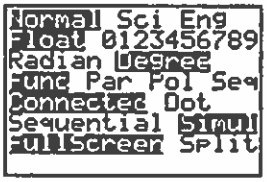
Visual Thinking and the TI-82 Graphing Calculator

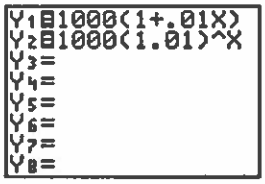
The purpose of this AFACCT workshop is to provide a hands-on experience using TI-82 Graphing Calculators. Through this experience the participants will explore some techniques for using graphing calculator technology to enhance visual thinking related to

the familiar topic from the mathematics of finance. The calculator techniques used are also appropriate to exploring introductory topics from the new and exciting field of chaotic dynamics. If time permits, we will begin to explore a few of those topics.

Future Value for Simple versus Compound Interest Deposits

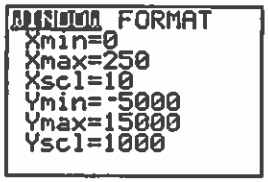
The following TI-82 activity explores the properties of simple and compound interest from a visual perspective. First press the MODE key and set the mode parameters as shown to the right.

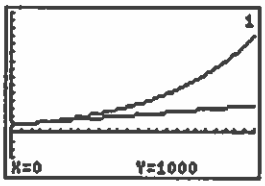




Next press the Y= key and enter the functions shown to the left. Function Y1 represents simple interest future value as function of time (X), and function Y2 represents the corresponding compound interest future value as a function of time. In both functions 1000 represents a one time deposit (principal) of $1000, time (X) is measured in months, and .01 represents an interest rate of 1% per month (12% per year).

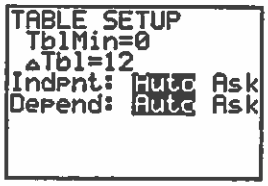
Now press the WINDOW key and set the values shown to the right. This will enable time (X) to vary from 0 to 250 months and future value (y) to vary from $0 to $15,000. (The Ymin value of -5000 instead of 0 simply provides some space at the bottom of the screen for displaying coordinates below the graph.





When you press the TRACE key, the graph to the left will be displayed. The 1 in the upper right corner of the graph indicates the coordinates shown below the graph correspond to function Y1 (simple interest). By pressing the right (left) arrow key, you can verify that the crosshair is tracing the lower (linear) simple interest future value function. By pressing the up or down arrow, you can move the crosshair to the upper (exponential) compound interest future value function. Now a 2 will be displayed in the upper right corner, and the left-right arrow keys will trace function Y2, with corresponding coordinates displayed below the graph.

Having explored these two functions from a visual perspective, you can also compare the same functions numerically. First press the 2ND-TBLSET keys. (These 2 keys are pressed in sequence - not simultaneously. TBLSET is printed in blue above the WINDOW key). Now set the parameters as shown to the right. These settings instruct the calculator to start the tables of values at X=0 and to calculate table values in X-increments of 12 (months).



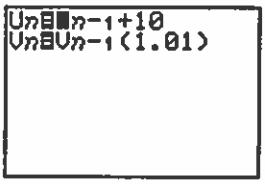
After pressing the 2ND-TABLE keys in sequence (TABLE is printed in blue above the GRAPH key) you will see the table of values to the left. The first column represents time in months (X), the second column represents simple interest future value (Y1), and

X	Y1	Y2
0	1000	1000
12	1120	1126.8
24	1240	1269.7
36	1360	1430.8
48	1480	1612.2
60	1600	1816.7
72	1720	2047.1

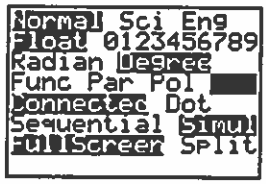
X=0

the third column represents compound interest future value (Y2).

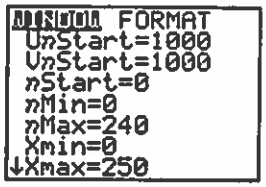
This functional/visual/numeric approach to the mathematics of finance provides a clear comparison of simple and compound interest simple future values as functions of time. One drawback to this approach, however, is that the exponential function Y2 is not very intuitive. Based upon graphical investigation and discussion of simple interest future value, it is not difficult for students to "discover" that the function is linear and the slope represents the amount of interest earned during the time period represented by X (monthly interest in the case illustrated here). It is also not difficult for students "discover" a computational technique for finding compound interest future value by iterating the simple interest future value function where the time increment (compounding period) is fixed instead the principal in allowed to vary.

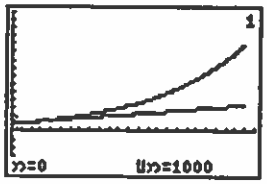


In order to investigate this approach on the TI-82 you must first press the MODE key and change from functional mode (Func) to sequential mode (Seq), as shown to the right. Next press the Y= key and enter the two sequences shown in the figure to the left. The first sequence represents simple interest future value (U_n) where n represents time in months, and the principal and interest rates are as before. (In order to enter the symbol U_n, press the keys 2ND-7 in sequence.) Notice that since you earn \$10 simple interest each month (1% of \$1000), the future value sequence is simply increased by 10 for each increment in n. The second sequence represents compound interest future value (V_n), (Press the 2ND-8 keys in sequence). Notice that since you increase the future value by 1% during each compounding period, the future value sequence is simply multiplied by 1.01 for each increment in n.



Next press the WINDOW key and set the parameters as shown in the next figure to the right. U_nStart and V_nStart are both set to 1000, representing the initial deposit of \$1000. In this case n is allowed to vary from 0 to 240 months (20 years). It is not necessary to change any of the other values pertaining to x or y. If you have already changed them, refer back to the earlier figure for the values of Xmin, Xmax, etc.





Now you can press the TRACE key to produce the graph shown on the left. Once again you can use the arrow keys to explore both functions and compare values with those derived in functional mode. Finally, you can press the 2ND-TABLE keys in sequence in order to examine these two sequences numerically, and to compare the sequential table to the functional table.

n	Un	Vn
0	1000	1000
12	1120	1126.8
24	1240	1269.7
36	1360	1430.8
48	1480	1612.2
60	1600	1816.7
72	1720	2047.1

n=0

Beyond the fact that both the functional and sequential approaches yield the same results, it is interesting to note that the sequence V_n generates what "appears visually" to be in the shape of an exponential function, without the explicit use of exponents. Through numeric and/or symbolic investigation of the sequence V_n, it is not difficult to "discover" the exponential function of time with which we started (Y2).

$U_0 = 1000$
$U_1 = 1000(1.1)$
$U_2 = U_1(1.1) = 1000(1.1)(1.1) = 1000(1.1)^2$
$U_3 = U_2(1.1) = 1000(1.1)^2(1.1) = 1000(1.1)^3$
...

My personal preference is to start teaching mathematics of finance with the linear function, relate that to simple interest and future value, introduce the sequential approach to computing future value with both simple and compound interest, and finally use the process above to find the more familiar exponential formula for compound interest future value. I adjust the level of rigor and sophistication to the level of the course in which mathematics of finance is being taught. The sequence approach offers clear opportunities to delve more deeply into the topics of sequences, series, and difference equations if desired. I have used the basic approach described here, without additional rigor, in an undergraduate mathematics course for students with only an elementary algebra background.

Turbulence and Chaos The struggle of physicists during the past century to understand turbulence has contributed to the evolution of the theory of chaos. David Ruelle provides the following illustration of turbulence in *Chance and Chaos*[6]:

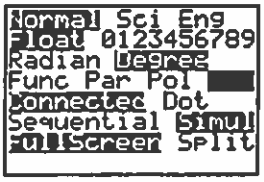
> ... think of water running through a tap. The power applied to the fluid (which is ultimately due to gravity) is regulated by opening the tap more of less. If you open the tap a very small amount, you can arrange a *steady* stream of water between the tap and the sink: The column of water appears motionless (although the tap is running). Carefully opening the tap a bit more you can (sometimes) arrange regular pulsations of the fluid column; the motion is said to be *periodic* rather than steady. If the tap is opened more, the pulsations become irregular. Finally, if the tap is wide open you see a very irregular flow; you have *turbulence*.

Experimentation and modeling of fluid systems in motion, aided by computer simulation and analysis, has led to the discovery of families of mathematical functions which behave in ways which are analogous to Ruelle's description of turbulence when they are iterated.

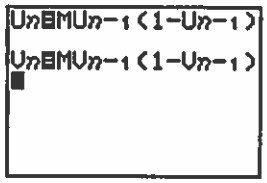
The Logistic Family of Functions One such family of simple mathematical functions is the logistic family[1]. The logistic family is based upon a special quadratic function $f(x) = \mu x(1-x)$. When the domain of x is restricted to the closed interval [0,1] and μ is constrained to a value between 0 and 4, then the range of f(x) also falls within the closed interval [0,1]. Iteration is performed by fixing a value of μ, choosing a value x_0, and then

[1] Although the logistic family illustrates mathematical behaviors similar to those described by Ruelle, logistic functions are not used in modeling fluid turbulence. One type application of involving the logistic family involves certain types of population studies.

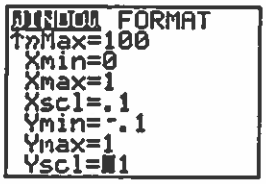
calculating the sequence of values (iterates) x_0, $f(x_0)$, $f(f(x_0))$, ... Since the range of f falls within its domain, all of the iterates are defined. What is of interest in the study of chaos is the behavior these sequences of iterates for different values of x_0 and μ.



We can use the TI-82 to examine a few such examples of iterates from the logistic family of functions. We will use the sequence mode, so press the MODE key and verify that the settings on your calculator correspond to those shown in the figure to the left. Then press the Y= key and enter the sequences U_n and V_n as shown in the figure to the to the right. The letter M, used to represent μ, is entered by pressing the keys ALPHA-÷ in sequence. Notice that both U_n and V_n represent the same sequence.

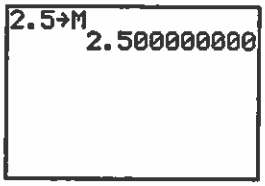


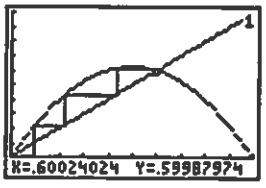
Next press the WINDOW key and set the parameters to the values shown in these two figures. Notice here that the sequences U_n and V_n are given slightly different starting values (x_0). One of the issues we will be exploring is how these two sequences of iterates differ when they are given starting values (seeds).



The next step is to change the graphing format from "Time" to "Web." This is done by pressing the WINDOW key and then pressing the right arrow key once to select the FORMAT menu. Then press the down arrow to highlight "Time" and then the right arrow to highlight "Web." Now press ENTER to make the change in graphing format. "Web" stands for "Cobweb," a special graphing format which I will explain in a moment.

Before we can proceed with graphing the sequences, however, we must initialize the value of M (μ). We will start with a value of 2.5. Press the keys 2ND-QUIT in sequence to return to the home screen. Now press the following keys in the sequence: CLEAR 2 . 5 STO ALPHA M ENTER. The resulting screen should look like the figure to the right.





At last we are ready to graph. Press the TRACE key, and a graph similar to that shown here should appear, although there will not be a "staircase" or "cobweb" in your graph yet. The inverted parabola represents the logistic function with μ = 2.5. The diagonal line represents the linear function y = x. Notice that the crosshair and coordinates are indicating the initial value of x_0 = .1 for the sequence U_n. (Recall that the number in the upper right corner indicates which sequence or function is being displayed.)

Now press the right arrow once and observe that the crosshair moves and a vertical line segment is drawn to the parabola. The value of Y represents $f(x_0)$. Press the right arrow again. The crosshair moves and a horizontal line segment is drawn to the line $y = x$. Press the right arrow a third time. The value of Y now represents $f(f(x_0))$. Press the right arrow two more times. (Wait for the horizontal line segment to be drawn after the first press before pressing the second time.) The value of Y now represents the next iterate in the sequence. Continue pressing the right arrow several more times. Does your graph look like the figure above?

Although this visual representation is very useful to study the behavior of the first few iterates of the sequence U_n, you soon stop receiving additional useful visual information. You can continue to watch the sequential changes of the coordinates at the bottom of the screen for awhile, but that too becomes tedious. This is not to suggest that the visual representation should be skipped; it reveals a general pattern but does not show all of the fine details.

n	Un	Vn
0.0000	.10000	.10001
1.0000	.22500	.22502
2.0000	.43594	.43596
3.0000	.61474	.61475
4.0000	.59209	.59208
5.0000	.60380	.60380
6.0000	.59806	.59806

n=0

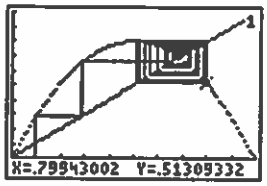
You can see additional numeric detail by using creating a table of values. First press the keys 2ND-TBLSET in sequence. Set "TblMin" = 0 and "DeltaTbl" = 1. Then press 2ND-TABLE to produce to the table to the left. You can use the down arrow to display additional table values. If you change "TblMin" = 100, you can produce the table to the right. Notice that both sequences U_n and V_n are represented in these tables. After about 15 iterations, both sequences appear to converge to a value of .6. We say that *f(x) has an attracting fixed point at .6.* If you reflect on Ruelle's description of the water tap, this behavior of iterates converging a fixed point corresponds to the *steady* stream of water which appears motionless.

n	Un	Vn
100.00	.60000	.60000
101.00	.60000	.60000
102.00	.60000	.60000
103.00	.60000	.60000
104.00	.60000	.60000
105.00	.60000	.60000
106.00	.60000	.60000

n=100

```
3.2→M
              3.200000000
```

You can now repeat the above calculator process for different values of x_0 and μ. For purposes of illustration, let's leave x_0 fixed for now and set M (μ) to a value of 3.2. This time "cobweb" graph, after about 20 iterations, looks like the graph shown in the figure to the right.



n	Un	Vn
20.000	.51309	.51309
21.000	.79945	.79945
22.000	.51305	.51305
23.000	.79945	.79945
24.000	.51305	.51305
25.000	.79946	.79946
26.000	.51304	.51304

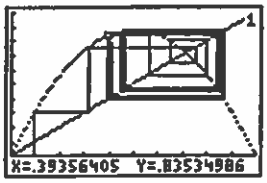
n=20

The corresponding tables of 20 and 100 values are shown here. Both the graph and the tables lead you to the conclusion that after about 25 iterations, both sequences tend to alternate between the same two values: .51304 and .79946. *We say that .51304 and .79946 appear to be attracting 2-period points* or that the pair of points represents an *attracting 2-cycle*. This periodic behavior is mathematically similar to Ruelle's *periodic* or

n	Un	Vn
100.00	.51304	.51304
101.00	.79946	.79946
102.00	.51304	.51304
103.00	.79946	.79946
104.00	.51304	.51304
105.00	.79946	.79946
106.00	.51304	.51304

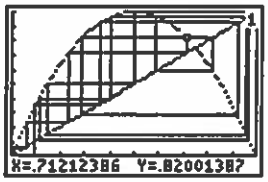
n=100

pulsating flow from the water tap. Increasing the value of μ appears to effect the logistic function in a manner similar to the effect of opening the water tap.



If you follow the same procedures with the same values of x_0 but μ = 3.5, you should get a "cobweb" graph like the one to the right after about 20 iterations. The corresponding table after 100 iterations should look like that to the right. This time the same four values appear to be repeating for both functions. We call this set of 4 points an *attracting 4-cycle*. Increasing the value of μ a little more appears to effect the logistic function in a manner similar to the effect of opening Ruelle's water tap a little more - the pulsating increases.

n	Un	Vn
100.00	.82694	.82694
101.00	.50088	.50088
102.00	.87500	.87500
103.00	.38282	.38282
104.00	.82694	.82694
105.00	.50088	.50088
106.00	.87500	.87500
n=100		



But now try to do the same thing with μ = 4.0! The "cobweb" graph, shown to the left after about 20 iterations, fails to reveal any pattern at all. Similarly, the table of values after 20 iterations shows now pattern. But there is another difference this time! The two sequences U_n and V_n do not seem to be tracking each other the way they did in the previous examples. And by the time you get out to 100 iterations, there is no discernable relation between the two sequences. Recall that the starting values for each sequence (x_0) were .1 and .10001 respectively.

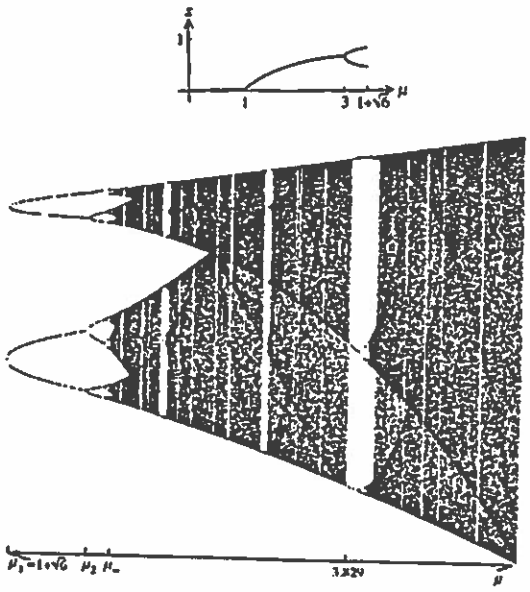
n	Un	Vn
20.000	.82001	.05697
21.000	.59036	.21490
22.000	.96734	.67487
23.000	.12638	.87758
24.000	.44165	.42944
25.000	.98638	.98009
26.000	.05374	.07807
n=20		

n	Un	Vn
100.00	.94036	.15537
101.00	.22433	.52492
102.00	.69602	.99752
103.00	.84630	.00991
104.00	.52030	.03924
105.00	.99835	.15082
106.00	.00658	.51228
n=100		

This situation in which small differences in initial values leads to unpredictable behavior in the subsequent iterates is called *sensitive dependence on initial conditions*. If you leave the value of μ = 4.0 and now try varying the initial conditions U_nStart and V_nStart, you will discover that the function $f_4(x) = 4x(1-x)$ appears to have sensitive dependence on initial conditions everywhere on its domain [0,1]. In this circumstance we say that f_4 is *chaotic*. The behavior of the sequence of iterates is unpredictable everywhere on the domain. This mathematical *chaos* corresponds to the irregular or *turbulent* flow from Ruelle's water tap when it is opened beyond some critical point.

The presentation above provides only a few snapshots of the behavior of iterates of selected members of the logistic family of functions. One final figure provides a more complete picture in a *bifurcation diagram* for the logistic family of functions, which was provided by Denny Gulick[7] and the University of Maryland Chaos Group. The diagram is presented in two parts, top and bottom, with differing scales for each part. Each horizontal axis represents μ, which spans the interval 0 to approximately 3.45 in the top diagram and 3.45 to 4 in the bottom diagram. Each vertical axis represents x (value of an iterate), which spans the interval 0 to 1 (with different scales) in both graphs. To prepare this bifurcation diagram, a computer was used to compute the first 700 iterates of $f_\mu(x)$, using an initial value of x = .5 , and 4000 different values of μ taking

increments of .001 in the interval [0,4]. For each value of μ, the first 200 iterates were discarded, and the remaining 500 iterates were plotted as ordered pairs along the vertical line segment [0,1] extending above the corresponding value of μ in the diagram. (The first 200 iterates were discarded so that the diagram would show the *eventual* behavior of the sequence of iterates for each value of μ.)



Thus each black point (plotted) in the bifurcation diagram represents the value of one or more of the sequence of iterates for $200 < n \leq 700$. Conversely, each white point (not plotted) represents the absence of any iterate for $n > 200$. Notice that our previous snapshots are consistent with this overall picture. The upper diagram shows a fixed point when $\mu = 2.5$ and a 2-cycle when $\mu = 3.2$. The lower diagram shows a 4-cycle when $\mu = 3.5$ and unpredictable (chaotic) behavior when $\mu = 4$. Although this bifurcation diagram is rich in additional detail, we will not explore it further here. Iterates of the logistic and several other important families of functions are explored in the Gulick text and in the summer 1994 workshop *Visual Thinking in Chaotic Dynamics*.

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BRAVING CHANGE: DEVELOPING A GENDER-BALANCED CURRICULUM

Lilli M. Downes

Abstract

This interactive presentation utilizes media and exercises to demonstrate real-life experiences of males and females in learning and interpersonal situations. Issues addressed include: (1) the androcentric bias of our historical culture and its resulting impact on choices for curriculum inclusion and conceptual frameworks of knowledge and reality; (2) differences in traditional communication styles by gender; (3) the communications gender-gap and ways it may affect students' self-esteem, education type and quality, career choice, and income, as well as the nation's productivity; (4) ways in which the communications gender-gap may influence effective classroom instruction; (5) a recognition of gendered ways of knowing, thinking, and learning (Belenky, 1986); (6) the need for an inclusive curriculum which positively sanctions the differing realities and learning styles of the genders; (7) the need for an inclusion of women's scholarships, experiences, and concerns into the curriculum; and (8) some effective interaction and pedagogical strategies for building excellence for all.

Workshop Overview

Many educators and administrators, at all levels, are beginning to incorporate this new body of knowledge and pedagogy into their general, liberal arts curriculum. Participation in this session of "Braving Change" is designed to provide background information and awareness of the issues so that participants may choose to become part of this growing movement. As such, it is an empowering act for faculty and administrators desiring to become aware of gender-based issues in education so that they may become tools of educational excellence. To enhance individual and system-wide efforts, a bibliography for further reading and a course evaluation instrument is provided. These are intended to augment exploration of additional ways to modify-- as participants deem necessary and worthy-- personal pedagogy and courses *or* overall institutional curriculum transformation.

Assumptions

The first assumption underlying this workshop is that participants want to understand claims supporting transformation to a gender-balanced curriculum in American education. All educators want to be fair, not only in their classroom interactional styles, but also in the information they present to students. Yet, many faculty are unaware of how their courses may be biased. We plan to explore the extent to which gender-based differences in communication and learning styles and the exclusion of women's constructions of reality, concerns, and contributions from the curriculum may serve as barriers to excellence in teaching and learning. Therefore, it is also assumed that of each of us, as participants of this workshop, value the attitudes of "methodological humility" and "methodological caution" (Narayan, 1988). "Methodological humility" means, that to be open, one must strive for sincere understanding of the "insiders" point of view, conducting ourselves under the assumption that as an outsider (i.e., as someone new to the viewpoint or experience) we may be prone to missing or misinterpreting something. "Methodological caution" is exercised such that any attempted criticism is carried out in a manner that neither denigrates nor dismisses entirely the validity of the other's experiences and viewpoint. A third assumption of this author is that each of us realizes genuine curriculum transformation-- indeed any change-- is never accomplished wholesale. Hence, the name of this workshop and paper: "Braving Change."

With this in mind, let us first identify common obstacles to successful curricular change, with the intent that in recognizing such obstacles we are in a better position to avoid their limitations. Sociologist Victor Rios has noted three conditions which work against social change: "the change is not understood; the proposed change threatens basic security; and the proposed change is viewed by those it is intended to benefit as imposed on them" (as cited in Warren, 1989, p. 51). My basic, most general assumption is that, by clarifying what is entailed in the development of a gender-balanced curriculum, by uncovering the nature of the "gender-gap" in communication, and by suggesting pedagogical techniques and curricular modifications to enhance an inclusive teaching and learning atmosphere within the classroom, we all will benefit– students, educators, and the broader society.

The specific topics addressed in this paper and this workshop[1] are several interrelated issues pertinent to any gender-balanced project. These are to: (1) reveal bias in actual curriculum and in conceptual frameworks of knowledge on which curriculum is based; (2) investigate the nature of the "gender-gap" in communication and learning, particularly as related to gender-inequity in both the content and process of American education, and (3) demonstrate the desirability of a gender-balanced curriculum. I argue that, when entered into with the dual attitudes of methodological humility and methodological caution, attempts at curriculum transformation promise enhanced learning and educational quality for both sexes.

Definition

Although the concept of "gender-balanced curriculum" is somewhat controversial due to its inadequacy to express the assumption that there are diverse and plural streams of women's and men's experiences,[2] it is defined herein in two ways. First, it denotes a movement in education which values a curriculum that includes both genders in processes of teaching and learning and that notes how gender influences student behavior and learning– both singly and interactively with other variables, such as race/ethnicity, socioeconomic class, and age. As such, this movement enhances both multicultural education and cooperative learning.

Secondly, it incorporates a pedagogical stance which stresses the recognition of gendered ways of knowing, as well as curricular inclusion of women's scholarship and women's concerns. Some contemporary philosophies, theories, and research results indicate that female students may prefer ways of knowing, thinking, and learning which are different from their male counterparts. Such pedagogy is based on assumptions which are different from traditional, objective ways of knowing, and hence, results in more cooperative teaching methods. Likewise, some research evidence indicates that cooperative learning may enhance the learning of females and deepen the multicultural insight of males, augmenting the educational quality for both sexes.

Historical Background

Research throughout the 1970s-1990s challenges traditional assumptions about the egalitarian nature of the American education system. The silence or invisibility of females in the current education debate suggests a myth which says that females and males have identical and equal educational experiences. Nothing could be further from the truth! Whether one looks at curriculum design and conceptual frameworks for knowledge, classroom climate–including student-teacher interaction, or pedagogical techniques, two general items become clarified: that sex and gender make a difference in the nation's public elementary, secondary, and post-secondary schools and that experiences by the sexes are, indeed, unequal (AAUW, 1992; 1991; Sadker & Sadker, 1986; 1985; Arliss, 1991, p. 47-48). From grade school to graduate school, classrooms and curriculum at all levels are characterized by a general environment of inequity and exclusion of differences based on gender and other intervening variables including race/ethnicity, socioeconomic class, and age. In short, the public educational system is not meeting females' needs. Girls and

boys enter school roughly equal in measured ability, but twelve years later, girls have fallen behind their male classmates in key areas of academics, such as higher-level math and science, as well as in measures of self-esteem (AAUW, 1992; 1991; Hall & Sandler, 1982).

Despite the fact that for more than two decades researchers have identified gender inequity as a major problem at all levels of schooling, only now in 1994 is it, perhaps, becoming a significant part of the national debate on educational reform. Meanwhile, some progressive educators, national organizations, and funding sources have been spearheading change in this area (AAUW, 1992; 1991; Hall & Sandler, 1982; Sadker & Sadker, 1986; 1985). For instance, the past two decades or so have witnessed an increasing number of faculty development projects designed to balance and integrate the curriculum. These projects have taken place at more than 100 universities, colleges, and recently at community colleges.[3] Generally, their focus is centered on both process and content: (1) the course content which is taught and (2) the processes of teaching and learning.

Some Areas of Concern Requiring Change

Bias in Curriculum and Conceptual Frameworks.

Curriculum, at all levels of American education, typically has been faulted for its myopic view-- for its failure to reflect "the multitude of interests and realities" as grounded in varied life experiences (Millman & Kanter, 1987, p. 29). Biased assumptions about gender may be explicit or implicit in many of the texts and topics assigned in the classroom. Diligent questioning of assumptions protects educators from inadvertently adding to the problem of inequity. In essence, previous conceptual frameworks[4] for knowledge have entailed two basic elements: (1) an "up-down" thinking, in that what is defined as "up" is assumed to be naturally superior to what is "down," and (2) a "logic of domination," the premise that assumes that the so-called superiority of the "up" justifies subordination (as cited in Warren, 1989, p. 46). With regard to gender-based transformation projects, concern over up-down thinking centers around two conceptual frameworks: "patriarchal conceptual frameworks" in which knowledge, beliefs, and values traditionally identified as male are accorded higher weight than what is traditionally identified as female and, secondly, scientific frameworks which assume the superiority and immutability of objectivity, rationality, and value-neutrality in scientific inquiry. By arguing that much scientific (including social and behavioral scientific) knowledge is incorrect due to its androcentric bias, critics of mainstream, androcentric curriculum have highlighted a time-honored premise in science: that the methodology one uses and the questions one asks, influences the answers one receives.[5] Note that this bias also holds true for other bodies of knowledge, including history, religion, cultural studies, philosophy, art, literature, and linguistic and communication studies.[6]

Scholarship related to mainstream curriculum, with the goal of curriculum revision, has stressed the need for "contextualizing discourse" by asking prefixing questions such as, "For whom?" and "According to whom?" This "prefixing" enhances critical inquiry and reveals scholarship and curricula which masquerades as inclusive. In doing so, it raises questions as to whether a particular conceptual framework is truly representative of the realities of diverse groups, makes visible the role of privilege and power in choices for curriculum inclusion, and, in doing so, supports the argument for curriculum and pedagogical transformation (Warren, 1989).

In conventional courses, there is a tendency either to ignore, trivialize, stereotype (as in example which use wives of famous men), or ghettoize female scholarship and issues of interest to females. For instance, in many social and behavioral science courses females are ghettoized, that is, confined to certain topics, such as chapters on social problems or abnormal psychology. This creates and maintains the view that females and areas of life affecting them are irrelevant in other areas of the course. It also implies that they must stay in their "proper place" and that they are problems-- exceptions to the rule, "less than," and "deviant from the norm." Most significantly, ghettoization fails to uncover the intersection of race and ethnicity, class, age, and gender, as well

as structural variables, such as institutionalized discrimination, which account for differences in life chances. As such, students learn an erroneous and dangerously simplified version of reality. Ponder, for instance, the fact that even after Madame Curie won a *second* Nobel prize, the all-male Academie would not admit her to their exclusive club. Today, the Academie still has only three female members (AAUW Membership Form, 1993).

Various stage-type models for curriculum change geared toward inclusiveness have been proposed (Andersen, 1988; McIntosh, 1983; Schmitz, 1985; Schuster & Van Dyne, 1985; Tetreault, 1986; Warren, 1989). The intended goal of all these models is to reach a final stage wherein the following assumptions are challenged: primary and secondary content areas, conceptual frameworks and organization of knowledge, professional role models, language, pedagogy and the politics of teaching. The goal is for achievement of a multi-focal, balanced, relational level which "fuse[s] both women's and men's experiences into a holistic view of human experience" (Tetreault, 1986), which takes seriously the conceptual and historical connections between sexism and other "isms," and which views the cause of gender inequity as complex and historically influenced (Lerner, 1975; Tetreault, 1986; 1985 Warren, 1989).

Secondary or Hidden Curriculum: Classroom Climate Issues and Pedagogy.

Understanding the biases of conceptual frameworks and the need for curriculum transformation to make the invisible (i.e., female scholarship, concerns and issues, and ways of knowing) visible is only a first step. Next, questions of "climate" and pedagogy must be addressed. Is my class a "chilly" (uncomfortable) one for women? Are teaching techniques, which ignore female ways of learning, knowing, and communicating, used as a matter of course in my classes? If so, what new pedagogical strategies, sources, and illustrations might I use to broaden the framework?

Classroom instruction often is based on the erroneous notion that treating everyone the same is the basis for equality. As such, differences are ignored, ghettoized, or denied. Language and communication and teaching strategies are two such examples. In any classroom, instructors inadvertently may discriminate against a particular sex (in these examples: females) if they develop only one type of interaction strategy (e.g., competition over cooperation; lecture over discussion; relying solely on volunteered responses over drafting student responses). Interaction and certain teaching strategies can make some groups (e.g., women) invisible and alienated from the learning experience, resulting in a "chilly climate" for those groups (Hall & Sandler, 1982; College Park, 1992). When this occurs, the Caucasian, Christian, middle-class, middle-aged, heterosexual norm becomes the definition of *qua human*, resulting in not only biased conceptual frameworks and curriculum, but also an imperfect (to say the least) learning environment.

Research has demonstrated differences in preferred communication and interaction styles by gender (Arliss, 1991; 1993; Henley, 1977).[7] Differences by gender in the quantity and quality of classroom participation also have been reported. In general, male students have been reported to speak more often and for longer periods than their female counterparts at all education levels. (See Chapter 4 in Arliss, 1991.) Still other studies show that male students both initiate communication with teachers and receive more feedback, especially encouragement and remediation, on their performance from teachers far more than do female students regardless of the teacher's sex [8] (Sadker & Sadker, 1986; 1985; Chapter 4 in Arliss, 1991; 1993). Teacher-student interaction patterns in science and math classes are often particularly biased (AAUW, 1992; 1991). Regarding teacher attention, studies report that African American females have even fewer interactions with teachers than do Caucasian females. General indications are that the ratio and quality of teacher attention follows this hierarchy: White male; Black male; White female; Black female. The consequences are devastating-- both at the personal and the social level. At the simplest and yet most profound level, self-esteem and self-confidence suffers, especially for Caucasian females who are socialized to associate personal self-esteem with school experience much more than are African American females (AAUW, 1992; 1991).

This leads to differences in preferred pedagogy. For instance, traditional females show a marked preference for interactive and relational techniques, such as discussion and sharing of learned experiences; whereas, conventional males lean toward more competitive and absolute forms of expression and learning. Yet, research continues to reveal a tendency, beginning at the preschool level and continuing through all levels, for educators to choose classroom activities that appeal to males' interests and to select teaching formats in which males excel. Likewise, teaching methods that foster competition are still standard, although a considerable body of research demonstrates that girls-- and many boys-- learn better when they undertake projects and activities cooperatively, rather than competitively (AAUW, 1992; 1991).

Recommended Strategies

1. Assumptions about gender may be explicit or implicit in many texts and assigned topics. A commitment to critically questioning assumptions and research findings-- both their sources and implications-- is an important first step to change.
2. Ask other questions, such as have the materials and ideas presented in various disciplines been ideological sources for justification of these assumptions and for excluding women from public participation. For instance, are there assumptions of biological and temperamental limitations?
3. Examine texts, lectures, and assignments for inclusiveness, and mainstream women's scholarship and women's issues early in the course, continuing throughout.[9]
4. Counter a chilly climate by encouraging women to talk in class.[10] Call on both women and men (even the more silent ones) directly, by name, and in roughly the same proportion as their ratio in the classroom.
5. Wait approximately 5-10 seconds for answers to your questions, recognizing that women often think longer about their answers than do men.
6. Remediate and encourage women as well as men with comments and questions like, "Tell me more" or "Why is that so?" This implies that the student and his or her response are worthy.
7. Avoid the generic pronoun "he" or "mankind," and encourage the same from students.[11]
8. Read about and practice inclusive interaction techniques, such as disucssion techniques and cooperative learning strategies, e.g., "Forced-choice" question or "Think-Pair-Share."[12]

.....

Ponder the example of Madame Curie given earlier. What do Madame Curie and the French Academie have to do with the process and content of education in the 1990s-- of contemporary social reality? Unfortunately, they have much to do with the very predicaments and issues of women today! Women are still seen as exceptions to the rule-- "as less than." Women are still finding that existing in the same society-- in the same time and place-- does not guarantee equity, be it in education, or in any social sphere. By studying what happens to females in school, or in any part of society and culture, we and our students gain valuable insights into what must change in order for each student, each person, to achieve his *or* her dreams and so that society and its institutions can claim a condition of human equity.

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What we call civilization has been built by men and women. Women have, throughout historical time, been excluded from the creation of symbol systems, while all the time they have been sharing, with men, the work of the world.... The causes of this inequality are ancient, complex, and historically determined.... Women, as well as educated men, are challenging the one-sided view of life and the world which our androcentric civilization offers us as absolute truth. We are saying that [one] side of the truth has not been told and now must be seen. **-- Gerda Lerner (1975).**

I invite you to brave the change of genuine curriculum transformation for gender [and for all forms] of inclusiveness-- at whatever level you feel comfortable and deem necessary and worthy. With such efforts, women's voices no longer will be silent; they, too, can choose the avenue of "claiming an education."[13]

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Identifying Information

Lilli M. Downes is Associate Professor, assigned jointly to Psychology and Sociology Departments, of Harford Community College, 401 Thomas Run Road, Bel Air, MD 21015

Endnotes

1. The present workshop for AFACCT Conference, 1994 is a scaled-down version of a previous workshop given at Harford Community College as part of its Globalizing the Curriculum Project.

2. For discussion on this issue, see Peggy McIntosh, "A Note on Terminology," Women's Studies Quarterly 11 (Summer), 1983 and Margaret Andersen, "Changing the Curriculum in Higher Education," Signs, 12 (2), 1987.

3. For example, see the Towson State University/Maryland Community College FIPSE Project, and the resulting publication, Community College Guide to Curriculum Change: Integrating The Scholarship on Women," edited by Elaine Hedges, Myrna Goldenberg, and Sara Coulter, 1990.

4. As defined by Karen Warren, "Feminism and Ecology: Making Connections," Environmental Ethics (Spring), 1986: a conceptual framework is a set of basic beliefs, values, attitudes, and assumptions that constitute the "lens" through which we see ourselves and our world

5. See for instance, primatologist Donna Haraway, "Primatology is Politics by Other Means." Pp. 77-118 and Sarah Hrdy, "Empathy, Polyandry, and the Myth of the Coy Female," Pp. 119-146 in Feminist Approaches to Science, edited by Ruth Bleier, NY: Pergamon, 1986 Also see Carol Gilligan, "Women's Place in Man's Life Cycle." In Feminism and Methodology, edited by Sandra Harding, Bloomington, IN: Indiana University Press.

6. See the book, Mothers of Invention by Ethlie Ann Vare and Greg Ptacek, NY: William Morrow and Company, Inc., 1988, for examples of "up-down" thinking in awarding females credit. For a literary illustration of gendered "ways of knowing," see Margaret Andersen, "Changing the Curriculum in Higher Education" Signs, 1987, 12 (2). For broad coverage of communication, see Laurie P. Arliss, Gender Communication, Prentice Hall, 1991 and Women and Men Communicating, Harcourt, Brace, Jovanovich, 1993.

7. See Arliss for an overview of research and issues in language, and see Henley for issues of power.

8. These studies generally indicate that male students talk more than female students regardless of the sex of the teacher. They all also point to a common possibility: females may allow others to talk more, even when the female holds the higher status. (See Laurie P. Arliss, 1991, p. 47 for further explanation.)

9. For suggestions see Kathleen Doherty Turkel, "Teaching About Women to Male-identified Students," Teaching Sociology, 14 (July), 1986:188-190; Alex McDavid, "Feminism for Men 101: Educating Men in Women's Studies." Feminist Teacher 3, 1988:25-33; and Laura Kramer & George T. Martin, "Mainstreaming Gender: Some Thoughts for the Nonspecialist." Teaching Sociology 16 (April), 1988:133-140; and Project on the Status and Education of Women, "Working Bibliography for Classroom Climate Issues," 1982 and "Evaluating Courses for the Inclusion of New Scholarship on Women," 1988, Washington, DC: Association of American Colleges,.

10. See The Teaching Professor, August/Sept., 1992 for strategies as adapted from Sandler & Hoffman, 1992.

11. See: American Psychological Association, Guidelines for Nonsexist Use of Language, American Psychologist, 1975 and Guidelines for Nonsexist Use of Language in APA Journals, American Psychologist, 1972.

12. See: Women's Studies Quarterly, XV (3-4); Special on Feminist Pedagogy (Fall/Winter), 1987; "Sources for Integrating Into the Traditional Curriculum." Pp. 222-226 in Comm. College Guide to Curriculum Change, edited by Elaine Hedges, Myrna Goldenberg, and Sara Coulter as part of Towson State Univ./MD Comm. College FIPSE Project, 1990; Carolyn M. Shrewsbury, "What Is Feminist Pedagogy?" Women's Studies Quarterly XV: 3 (Fall/Winter), 1987; Sue Rosser, "Warming Up the Classroom Climate for Women," Feminist Teacher, 4(1); James W. Loewen and Samuel F. Sampson, "Getting Gender on Their Minds," Teaching Sociology, 1986, 14 (July). See VHS videos "Interactive Classroom, Parts 1 & 2" and "Think-Pair-Share," NEA Professional Library, P. O. Box 509 West Haven, CN.

13. From the essay by Adrienne Rich, "Claiming and Education," Pp. 84-89 in College 101: A Freshman Reader, edited by John D. Lawry. Originally appearing in Rich's collection, On Lies, Secrets and Silence, 1979.

MEETING THE CHALLENGES OF EDUCATING THE POSTSECONDARY LEARNING DISABLED STUDENT

Dr. Linda Schnapp

Abstract

This presentation is intended for faculty, staff and support personnel in higher education. The issues to be discussed include defining and assessing the learning disabled students, identifying specific curriculum strategies, determining reasonable accommodations, and improving faculty, staff and support personnel attitudes toward the learning disabled student.

Educators today are still struggling to understand the term "learning disability." Several contemporary educators have suggested that learning disabilities are not a single disability. Instead, they believe that the learning disabled individual may actually be affected by a number of similar, but different, handicapping conditions. Additionally, the chronicity of learning disabilities has not been understood until fairly recently. Educators seemed to believe that, once the learning disabled individual reached a certain age, possibly adolescence, the learning disability would dissipate. Today's educators, however, realize that although intervention and maturation may influence cognition, language, academic achievement and psychosocial development, the learning disabled adult continues to demonstrate difficulties in understanding, retaining and expressing information. The most common manifestations of these problems occur in the areas of reading, writing and spelling. Other frequently troubled areas are organization skills, time management and self-esteem.

The awareness of the chronicity of learning disabilities has been reflected in its changing definition. The first, and most widely accepted formal definition of learning disabilities, was developed for children. It was formulated by the National Advisory Committee on Handicapped Children (1968) and was later incorporated into the Education for All Handicapped Children Act of 1975, Public Law 940-142. As educators became more aware of the continuing, albeit changing, nature of the disability, they recognized the need to modify the definition so that it applies to adults as well. Therefore, one definition of learning disabilities that is commonly accepted today was developed in 1981 by the National Joint Committee of Learning Disabilities. It states:

> Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities.

> These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span....

Other accompanying changes have occurred in the field of learning disabilities. Since the 1980's, there has been a dramatic increase in the number of students with learning disabilities attending colleges and universities. This increase was predictable for two reasons. First, the Education for All Handicapped Children Act of 1975 had been in effect long enough for a large population of students to have gone through public education after having been identified and provided with special education. Second, this increase was legally supported, primarily by two federal statutes, Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. According to Section 504 of the Rehabilitation Act, otherwise qualified individuals with handicaps could not be discriminated against by recipients of federal financial assistance, and virtually all colleges are recipients of federal financial assistance. The individual must be qualified to perform the essential requirements of the program "in spite of" the handicap. Although Section 504 requires "reasonable accommodation," it does not require any fundamental change in the nature of the program. It states that decisions concerning the provision of accommodations in particular situations will be decided on a case-by-case basis. The Americans with Disabilities Act, which was passed because most services, programs and employers were not covered by the Rehabilitation Act, is very similar to the Rehabilitation Act.

By the late 1980's, two trends were apparent in the postsecondary education of learning disabled students. First, service providers in many colleges and universities were being inundated by the large number of learning disabled students requiring services. Second, a disproportionate number of disabled students were attending two-year colleges as compared to universities. As a result, personnel at the community colleges frequently found themselves confronting significant problems in their attempts to meet the needs of the learning disabled student.

The problems that community college personnel have been dealing with are of various kinds. The first problem is that, in addition to the lack of clarity inherent in the label "learning disability," the learning disabled student himself frequently does not understand the nature of his disability. Many come to college without documentation or with documentation that does not clearly spell out the areas in which the student demonstrates specific processing difficulties. Because experience has taught the learning disabled student to focus on his/her learning weaknesses, he/she frequently does not know his/her learning strengths. Such students often develop low self-concepts and, as shown in a recent study by Huntington and Bender (1993), experience an excessive degree of anxiety and depression. As a result, they may demonstrate less motivation than nondisabled students to succeed academically.

Second, some learning disabled students have difficulty in accepting their disability. They appear to either deny their disability or to be overconfident. They require counseling to develop an awareness of the effect that their disability has on their learning and daily living skills.

Third, many learning disabled students have not developed the independence they need to adjust to college. For many, the first day at college marks the first day in their lives when their education has not been under the direction of Public Law 94-142. They do not know how to self-identify, to seek out appropriate support services, or to enumerate suitable accommodations or modifications.

Fourth, many learning disabled college students lack the necessary academic preparation to succeed in college. Others have not developed the study skills required for success. For many, a decision will have to be made by those offering support at the college level as to whether the primary emphasis should be on the remediation of basic skills or on subject-matter tutoring.

Fifth, one of the greatest ongoing challenges faced by the learning disabled college student today is gaining and maintaining the acceptance and cooperation of academic faculty. Recent studies, such as those conducted by Leyser (1989) and Minner and Prater (1984) on the attitudes of faculty members toward learning disabled students, found that even those faculty members who supported accommodations for students with sensory and physical disabilities took a negative approach to accommodations for learning disabled students.

There are additional problems with contemporary programs for learning disabled college students. These include the absence of programs that train specialists to meet learning disabled adults' needs, the variable interpretation of the requirements of Section 504 with regard to who qualifies as a handicapped person, resulting confusion about the extent of the reasonable modifications that must be made to accommodate such individuals, and the additional cost of these programs.

These issues present colleges and universities, particularly community colleges, with an ethical problem. Each time a tuition fee is received and accepted from such a student, the college is implicitly letting the student know that he/she has the potential to succeed and to benefit from taking the course. Therefore, it is ethically imperative for the administrative staff and the faculty of the college to meet the challenge of helping the learning disabled student deal with his/her disability. At this point, I would like to make some specific suggestions as to how this may be accomplished.

The first obstacle to be overcome is the lack of clarity inherent in the definition of learning disabilities. Additional psychoeducational, and sometimes medical, evaluations may be required to determine which individuals are actually learning disabled. Because standardized, reliable and valid diagnostic instruments are scarce, the diagnostician will have to be very skillful in eliciting important qualitative information during the testing. Further information about the functioning level of the students may be gained from informal curriculum-based assessment practices.

The next issue, of course, is using the information obtained from the assessment to help the learning disabled student to plan his/her program. Careful academic planning should be based on the advisor's knowledge and understanding of the subject of learning

disabilities and of the specific learning disabled student's strengths and weaknesses, processing deficits and learning style. Course selection should also be based on information about the course itself. The following issues should be taken into consideration: (1) the way the course fits into the departmental sequence of courses; (2) the level of difficulty of the course; (3) the prerequisites or assumed background knowledge and skills of the course; and (4) the method of instruction. The learning disabled student might be asked to read the course description and syllabus in advance and, whenever possible, to speak to the instructor personally about these issues as well as about the reading load, the course requirements, and the frequency and method of evaluation. Through this discussion, the student could make arrangements for any necessary accommodations and/or modifications, and could determine reading assignments so that he might be able to start studying course materials during the intersession or summer vacation.

Because learning disabled students are generally required to attend classes and to compete with their nonhandicapped peers, most learning disabled students need accommodations in at least one of four areas: reading, language, mathematics and test-taking. Accommodations that could help students to bypass reading recognition and comprehension deficits might include: (1) taped textbooks, such as those available from Recordings for the Blind in Princeton, New Jersey, or Talking Books, at the Library of Congress; (2) prehighlighted textbooks in which key terms and concepts are highlighted with a felt tip marker; (3) guided notes for each chapter which include a summary of the main points and key terms listed in sequential order; and (4) metacognitive strategies, such as advanced organizers, that direct students to consider how they might interact with the text prior to beginning the reading assignment. The following accommodations are helpful in compensating for either oral or written deficits, but may also be used for students with deficits in both areas: (1) tape recorders to tape lectures or for students to use to dictate written assignments, such as essays, for future transcription and also headphones to help some students to focus their attention while listening and dictating; (2) copies of the professor's lecture notes to help learning disabled students to follow the lecture; and (3) collaboration between the learning disabled student and a classmate to produce a joint written paper. The following accommodations help students to compensate for difficulties in mathematics: (1) pocket calculators for computations; (2) half-inch graph paper to help in aligning math problems while taking notes or completing assignments; (3) test retakes and giving an average grade; and (4) tape recorded reviews of only the major components of important concepts. The following testing accommodations have been recommended: (1) allowing for untimed tests; (2) allowing a reader for objective exams; (3) providing essay rather than objective tests; (4) allowing for oral, taped or typed instead of written responses; (5) providing clarification and rephrasing of questions to bypass comprehension deficits; (6) evaluating the process as well as the answer; (7) providing alternative methods to evaluate progress (e.g., demonstrations); (8) avoiding double negatives and complex sentence structures when developing exam questions; (9) giving shorter, more frequent tests; and (10) providing no more than three choices on objective tests.

The purpose of offering accommodations and modifications is so that the learning disabled student will be able to learn and demonstrate mastery of course material within the restraints imposed by his/her perceptual handicap. At the same time, instructors are

concerned about not compromising the academic integrity of their courses. Faculty members are most likely to be cooperative when they are involved in the development, implementation and evaluation of accommodations. However, faculty members do not have to be overwhelmed by the presence of learning disabled students in the classroom. In many cases, instructors only need to arrange for or allow the accommodations needed by the student. When an instructor is not receptive to a student's needs, an alternative to that class should probably be provided.

Another issue that arises is whether learning disabled adults benefit from continued basic skill instruction. This problem is exacerbated by the realization that there is usually only a limited amount of time available to work individually with each learning disabled student, and time that is devoted to basic skills instruction cannot be spent on subject-matter tutoring. In deciding the answer to this question, it is important to remember that, although remediation of basic skills has played a major role in the instruction of the learning disabled throughout elementary and high school, data available from secondary programs (Deshler, Schumaker, Alley, Warner & Clark, 1982) indicates that learning disabled students have frequently reached a plateau by tenth grade which does not support continued emphasis on such instruction. One approach to this issue might be to integrate remediation and subject-matter tutoring by using the students' coursework to help them to acquire skills. Students are most concerned with successfully completing class assignments; therefore, they are more motivated to work on material that is directly related to their classwork.

The final area that needs to be addressed is that of social interpersonal skills. Educators agree that learning disabled students should be encouraged to develop self-knowledge, both about the nature and effects of their specific learning disabilities and about the way their behavior influences others. The most helpful feedback specifies the students' behavior and the feelings of the observer/listener. Cordoni (1982) has also suggested the use of peer advocates who can both accompany the student to various activities and provide a role model of appropriate behavior and verbal responses. Another forum for improving social skills is the self-help group. If possible, learning disabled students at the same school should be introduced to each other and encouraged to be part of an informal support group. Sharing frustrations, successes and survival strategies with peers can be a valuable part of the student's experiences.

Although it will be a challenge for educators to provide equal opportunities for the learning disabled college student, the important point to remember is that the learning disabled student can succeed in college. It is imperative to start moving now to actively address those issues in the field of postsecondary education which are readily discernible—issues of definition, assessment, service delivery and policy-making.

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Dr. Linda Schnapp, Learning Disabilities Specialist
Howard Community College
Columbia, MD 21044

MOTIVATING/RETAINING ADULT LEARNERS THROUGH A WORK-BASED CURRICULUM

Ruth Markulis

Abstract

This presentation showcases *Skills Today for Tomorrow*, a model work-based education project developed through Catonsville Community College in partnership with Printing Industries of Maryland and Southern Pennsylvania. The current grant is the second Workplace Literacy Grant funded by the U.S. Department of Education which Catonsville Community College has received. Catonsville Community College is presently sharing knowledge learned in the 1991-1992 Workplace Literacy Grant with three other community college partners in Maryland and southern Pennsylvania: Carroll Community College, Charles County Community college, and Harrisburg Community College.

Work-based curriculum cam range from basic reading, writing, and mathematics, or foundation skills, to more advanced mathematics, communication, and critical thinking and problem-solving skills.

This continuum of skill levels is important because as community colleges address basic educational needs, they are also preparing the groundwork for providing advanced technical training programs in the future. Businesses are more likely to award contracts to educational service providers who have competently served their basic skills needs in the past. Students are also more likely to continue their educational programs with community colleges which have served their basic skill needs.

Strong business/education partnerships can also be formed through alumni contacts in business and industry. Loyal alumni who have achieved skills which led to employment are excellent contacts for community colleges. These alumni are in a unique position to ascertain educational skill needs at the company and make referrals to the community college. In addition, they are living testimony to the value of education for both the individual and the employer and can provide the inspiration for some to pursue their educational and career goals.

This paper highlights key concepts in the development of work-based curriculum materials representing a broad range of skills. The steps covered range from conducting worker interviews and educational task analyses through developing completed learning activities. In addition, tips are given for integrating the principles of work-based education with current on-campus programs.

Rationale for Work-based Education
Why Business/Education Partnerships Are Necessary

There are a number of sound reasons for community college involvement in work-based education. Indeed, AFACCT's conference theme, "The Next Decade: New Challenges, New Opportunities," is especially appropriate in the field of work-based education. The new decade is unfolding in the midst of economic uncertainty, increased technological complexity, and a public perception of the need to improve traditional educational systems. Due to these factors, community colleges will be increasingly challenged to serve adults in the workforce during the next decade. Richard W. Riley, Secretary of Education, has acknowledged this challenge in the July/August 1993 issue of the *Adult Learning Journal*. He states, "Each phase of life requires a different kind of learning, and at the adult level it means closing the gap between school and work and creating a seamless and universal system of lifelong learning opportunities."

In addition to the new challenges for the future that face educational institutions, the profile of the "typical" community college student continues to change rapidly. The average age for college students is over thirty and continues to rise. Women and minorities are increasingly seeking community college services and skills to obtain or enhance gainful employment. Augusta Kappner, Assistant Secretary for Vocational and Adult Education, states in the Summer 1993 issue of "Workplace Network News," "...education gains have the greatest long-term payoff in terms of employment and self-sufficiency. Adult education can and must assume a stronger hand in developing human resources for the competitive workforce our nation's future demands."

While students seek to upgrade their skills, business organizations are increasingly turning to the educational community to fill a void as they face an underprepared workforce. Eighty-five percent of the expected workforce 2000 is already in the workforce, and the U.S. Department of Education is outlining a strategy to help equip those workers with the workplace education tools they will need, according to the Summer 1993 issue of "Workplace Network News."

Community colleges have a unique opportunity to establish themselves as viable resources for the business community and an ever-widening circle of non-traditional students. It is vital that community colleges assume a leadership role in refining their educational missions in order to meet these changing needs.
Work-based education programs can help community colleges to maintain credibility with both the business community and working adults. By using work-based curricula, community colleges can remain viable service providers for an educated workforce to the year 2000 and beyond.

How Is A Work-Based Curriculum Designed?

Procedures for designing work-based curriculum materials can be divided into four stages: gathering data on job requirements, analyzing the data through an educational task analysis, setting competency-based educational objectives, and designing the actual learning activities.

Gathering Data

Gathering data on job requirements can be done in several different ways, depending on whether the curriculum is to be taught at the worksite or on campus. At the worksite it is helpful to interview front-line supervisors on the training needs of their departments and to obtain the company's job descriptions for the positions in the department, if they are available. Another initial step is to have supervisors identify competent employees who can explain job requirements. These employees can be interviewed to determine skills currently required on the job and to identify training needs from the worker's perspective. Employees can be asked about manuals, forms, charts, etc., that are read or completed on the job, what they find most challenging about the job, and what skills have changed since they started the job, et. In addition, competent workers can be "shadowed" or observed on the job after it has been explained that the interviewer is interested in the academic skills involved in the job, and is not evaluating the worker. During worker interviews and observations, it is helpful to obtain copies of workplace documents which are routinely read or filled out by workers. These documents are extremely useful in customizing the curriculum for the individual company and later will be the basis for many learning activities in the curriculum.

Work-based curriculum materials can be used successfully in on-campus courses as well, though it may take more imagination and ingenuity. Working adults may view traditional coursework as abstract and unrelated to the demands of daily living. In this situation, work-based education curriculum materials serve as viable alternatives or as enhancements to the traditional curriculum. Adapting workplace documents for classroom use can be especially relevant and motivating for students who have a great deal of developmental coursework to complete before being eligible for credit courses. When students can apply something from the classroom directly to their jobs within a short time, coursework suddenly becomes more palatable. The satisfaction which students receive from these relevant exercises can help to give them the persistence necessary to attain their long-term educational goals.

Gathering data on job requirements is a bit more challenging with on-campus students, but activities can be developed to obtain the information and simultaneously obtain a high degree of student involvement. Currently employed students supply information in an interview and bring in job descriptions. In addition, want ads and job descriptions in the Dictionary of Occupational Titles can be used. The fact that students may be in different fields of endeavor can add to peer interactions and lively discussions.

Conducting the Educational Task Analysis

Analyzing Data

Once job-specific information has been obtained and job tasks have been listed by positions or departments, an educational task analysis can be conducted. This involves identifying vocabulary or jargon, forms, and tools or equipment specific to the job. In addition, job tasks are broken down into the basic reading, writing, and math skills necessary to perform them. It is equally important to identify some additional higher-level skills necessary to perform the job tasks, such as critical thinking and problem-solving skills, decision-making skills, and communication/team building skills. All of these skills can be thought of in terms of the skills workers need and employers want to ensure safety, quality, and growth on the job. Prioritizing skills by those that are most frequent and critical to the job and determining the readability level of workplace documents are additional enhancements which can be added to the educational task analysis.

Setting Competency-Based Educational Objectives

Once job-specific data have been gathered and analyzed, competency-based educational objectives can be written for each subject area based on the most frequent and critical skills required in the job. These competencies can then be sequenced from basic to more advanced, and a competency profile developed for each subject area.

Designing Work-Based Learning Activities

This step brings to fruition the work of the previous three stages in designing work-based curricula. In some ways this step is the most challenging and rewarding.

The first step in designing the actual learning activities to be used in the curriculum is to decide on a uniform format. This is definitely an activity where prior thought, planning, and preparation pay off. The more thoroughly conceived the design is, the fewer false starts will occur and the more satisfaction will be derived from the finished product. A skill module format which keeps instructor information, student pages, and answer keys together often works well.

Once a consistent format is achieved, objectives can be pulled for each learning activity from the competency profile previously developed. After that materials can be listed, procedures and directions developed, answer keys prepared, etc. Often times your workplace documents will be at the center of the activity.

Keep in mind that it is important to develop as many activities as possible for each objective as continued practice in a wide variety of applications is necessary for true skill mastery.

Conclusion

The field of Work-Based Education is an exciting arena which community colleges are only beginning to explore. This highly adaptable field can play a vital role in leading community colleges into the next decade and beyond.

Identifying Information

For more information, sample forms, or curriculum, write or call:

Ruth Markulis, Curriculum and Assessment Coordinator
Work-Based Education
Catonsville Community College
800 South Rolling Road
Baltimore, Maryland 21228
(410) 455-4919

CHEMISTRY 101 - OPTIONAL REVIEW MODULE INCREASES STUDENT SUCCESS

Stephen D. Cain
W. Robert Coley

Abstract

The content and teaching methods of general chemistry have been of considerable interest in recent years as faculty report poor student performance and a decline in chemistry majors. In 1990 the American Chemical Society established a task force to examine and enhance the chemistry curriculum.

At Montgomery College general chemistry consists of two courses: CH 101/102. The content is typical of that taught in most colleges and universities. The student population of CH 101 is heterogeneous in its previous chemistry experience, age and academic history.

To provide a "safety net" for students with weak chemistry backgrounds, an optional 15-hour, noncredit review module was developed at Montgomery College. The module is intended for students who technically meet the prerequisite, but do not have adequate command of important skills.

This presentation concerns a four-semester study of CH 101 students. Success rates and grades for those enrolled in the review module are compared with their peers.

Introduction

The content and teaching methods of general chemistry have been of considerable interest in the past decade as chemistry faculty report declining numbers of chemistry majors, high attrition rates, and poor student performance. In 1990 the American Chemical Society established a task force to examine the general chemistry curriculum and make recommendations for improvements. Since then numerous ideas have been explored in the chemical education literature to improve the quality of teaching and student performance.

At Montgomery College general chemistry consists of two courses, CH 101 and CH 102 (Principles of Chemistry I and II). In each course students meet three hours a week for lecture and four hours a week for laboratory. The prerequisites for CH 101 states that a student must have a "grade of C or better in either high school chemistry or CH 100 *[Introductory College Chemistry]* or consent of department."

The student population in CH 101 is the most heterogeneous of all chemistry courses at the college. The ages of students typically range from 17 to the mid-40's; in the day sections of the course, about one-half of the students are 20 or under. The previous chemistry experience of CH 101 students also cover a wide range. Some take CH 100 at the college, although most cite a high school course as the one fulfilling their prerequisite. There is tremendous diversity among the high school courses in their content and quality. In addition, the elapsed time between the previous course and enrollment in CH 101 varies considerably.

With the hope of improving student performance and providing a "safety net" for students with weak or dated chemistry backgrounds, an optional 15-hour, noncredit review module was developed several years ago. The review module, designated CH 101A, is intended for students who technically meet the prerequisite, but do not have adequate command of important skills due to a weak or dated experience in their previous chemistry course(s). CH 101A sections meet daily during the first three weeks of the semester. For tuition purposes, it is counted as the equivalent of one credit.

At the first lecture meeting of CH 101, students receive a handout delineating the "review topics" skills they are expected to have learned in their previous chemistry course(s) and which are critical for success in CH 101:

1. writing the chemical formula for an inorganic compound if given a name
2. writing the name of an inorganic compound if given a formula
3. performing basic mole calculations such as mass-mass, mole-mole, mass-mole, particle-mole, particle-mass
4. performing basic stoichiometry calculations
5. balancing chemical equations (not including complex oxidation-reduction)

These "review topics" are covered only briefly in the lecture of CH 101. Emphasis in the first three weeks of class is on new material. Students are expected to strengthen their review topics skills as necessary during this time, either on their own or by enrollment

in CH 101A. Student familiarity with the review topics is diverse. Some could take the review topics exam on the first day of class and earn a grade of 100%; others are not sure of simple formulas such as H_2O or NaCl. During the fourth week of class, all students are given an exam covering these topics.

Methodology

This study was conducted by examining data collected from college transcripts, instructor grade books and student exams for approximately 200 students. Grade statistics were complied and sorted with a grading software package. Three lecture instructors were involved; their experience teaching CH 101 (or similar courses) ranges from 8-18 years.

All students (CH 101A and CH 101.2) were monitored on the following:

1. Grade on the Review Topics Exam
2. Average Grade of the One-Hour Exams
3. Grade on the Final Exam
4. Grades on Specific 101A-related Final Exam Questions
5. Course Grade for CH 101
6. Course Grade for CH 102 (if taken at Montgomery College)

In addition, all students in section 4 were given a pre-test diagnostic quiz during the second lecture period to evaluate their readiness for CH 101 material. In sections 1-3 this diagnostic quiz was administered only to CH 101A students on the first day of the review module.

Analysis

In order to judge the effectiveness of the CH 101A module, pre-course, in-progress and post-course student data was analyzed. The specific **pre-course** information examined was: (1) students' previous GPA or status, (2) students' personal data such as age and sex, (3) student performance on the diagnostic quiz, and, (4) student performance in CH 101 of those who had previously taken CH 100, Introductory College Chemistry. Then, **in-progress** data were evaluated; in this study exams throughout the course were monitored. In addition, data from item analyses on the final examination were compiled. Finally, **post-course** progress in CH 102 was monitored.

The performance of students who took the CH 101A module was compared to the performance of those who did not. In this report, students who took the module are identified as **CH 101A**; those who did not are referred to as **CH 101.2** (the college transcript designation). With the exception of the module taken by 101A students, the lab and lecture experiences of both groups were identical.

Although some students signed up for the review module during regular registration, most added it after the first class session of CH 101, during which the treatment of review topics was introduced and the module was explained. In sections 1-3, enrollment in 101A was left primarily to student discretion after consultation with the instructor. In section

4, a diagnostic quiz was given to all students and a recommendation to each was made after evaluation of the quiz.

Two benchmarks were used to determine effectiveness of CH 101A in improving fundamental chemistry skills: *average CH 101 course grade* and *success rate.* (A course grade of A, B or C is considered "success" since this is the prerequisite for the subsequent course, CH 102.) The group of CH 101A students achieved a higher average course grade and a higher success rate. Forty-five (81.8%) of the 55 CH 101A students earned an A, B or C grade, while seventy-two (71.3%) of the 101 students in CH 101.2 achieved an A, B or C. Overall, 117 (75.0%) of the 156 students who completed CH 101 were eligible to enroll in CH 102.

Analysis of Students by College Experience

Students who had previous college experience benefitted from enrollment in CH 101A. Those who opted for the review module had a success rate of 82.1% compared to 73.8% for those who did not. In addition, the CH 101A students had a mean course grade of 2.51 (median=3.00), compared to 2.21 (median=2.00) for 101.2 students.

Of the students who took CH 101 during their first semester at Montgomery College, 16 (28.6%) were enrolled in the 101A module; forty were not. The average letter grade of the CH 101A students was slightly higher than 101.2 students, but the success rate was dramatically higher. CH 101A students in this category earned an average letter grade of 2.38 (median=3.00), while those in CH 101.2 earned 2.35 (median=3.00). Even though these average grades were similar, a stark difference in the success rates of these students occurred (81.3% of 101A students earned an A, B or C, while only 67.5% of 101.2 students accomplished the same) due to the large number of failures in the 101.2 group.

Analysis of Students by Age

Maturity played a significant role in student success. Of the 15 students 31 years of age or older, **all** of them earned an A, B or C, (100.0% success) whether or not they took CH 101A or not. All but one student in the 25-30 category earned an A, B or C (93.8% overall success). In this age group, 50.0% of the students enrolled in CH 101A.

As the age range gets lower, so does the success rate. For the age 21-25 group, there is a notable difference between the 101.2 (70.8% success) and the 101A students (81.0% success). The youngest age group, our "traditional" students, had lower success rates than their older counterparts. Even still, there was again a marked difference between the 101.2 students (63.9% success) and the 101A students (73.7% success).

Analysis of Students by Gender

Fifty-eight females (37.2% of all CH 101 students) took CH 101 in the four classes of this investigation; twenty-three (39.7% of females) selected the 101A module. That is a greater proportion than the males, of whom only 32 (32.7% of males) took 101A.

The success rate of 101A females (78.3%) was much greater than 101.2 females (68.6%). Males who took CH 101A benefitted as well: the success rate for 101A males (84.4% was greater than the 101.2 males (72.7%).

Analysis of Attrition

Class lists distributed on the first day of the semester were analyzed to determine the ultimate destination of each student registered. Those who dropped on or before the first day of class were not included in the totals. As of the first days, 207 students had signed up to take CH 101. Eight of them were auditing. Of the remaining 199 students, 43 (21.6%) withdrew before the conclusion of the course. Some of those withdrawals came within the first few weeks of the course; others came after midterm. At Montgomery College, withdrawals in the early weeks of the semester are made with no "W" appearing on the student's transcript. Nevertheless, regardless of transcript status, any student who withdrew once the course had commenced was included in the attrition rate for this study.

Category	*Number of Students Taking CH 101 for Credit*	*Number Attritting and Percentage of Group*
STATUS		
CH 101A	68	13 (19.1%)
CH 101.2	131	30 (22.9%)
SEX		
Female	77	19 (24.7%)
Male	122	24 (19.7%)
AGE		
≤20	105	25 (23.8%)
21-25	56	11 (19.6%)
26-30	19	3 (15.8%)
≥31	19	4 (21.1%)
STANDING		
Experienced Student	137	37 (27.0%)
First-Semester Student	62	6 (9.7%)

Grades on Cumulative Final Exam

Each instructor gave a cumulative, 200-point final exam which every student was required to take. Students were allowed two hours to complete the exam. Each exam consisted of a multiple-choice section, a short-answer section, and a problem-solving section involving calculations.

Student scores on final exam items were collected and analyzed. While their skill level in all areas is below that of their 101.2 counterparts at the beginning of the course, CH 101A students developed and retained significant competence in nomenclature and equation balancing. In all sections they consistently scored higher on the problem-solving sections of the test than the 101.2 students. Such questions involving calculations typically involve the most demand for critical thinking skills.

Performance in CH 102

Students who took CH 101A had a higher mean grade in CH 102 as well as a higher success rate. Among those who had taken CH 101A, there was a 93.3% success rate. Their mean grade in CH 102 was 2.67 (median=3.00). The mean CH 102 grade for the CH 101.2 students was 2.59 (median=3.00) and the success rate was 81.3%.

Conclusions

When CH 101A was added to the curriculum at Montgomery College, it was hoped that at-risk students could benefit from an extra emphasis on fundamental chemistry skills. This assessment study has shown that these students not only perform as well as their peers, but can actually perform *better* than their peers. The effect of CH 101A has been to raise student skills so that their performances equal or surpass their peers who have more recent prerequisite chemistry experience.

This study is limited to the statistical data that can be obtained from transcripts and grade books. Clearly there are a number of intangible factors which may also be at work, including maturity, motivation and diligence.

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Stephen D. Cain is Assistant Professor of Chemistry, of Montgomery College, 20200 Observation Drive, Germantown, Maryland, 20876.

W. Robert Coley is Professor of Chemistry, of Montgomery College, 20200 Observation Drive, Germantown, Maryland, 20876.

BEYOND SPELLCHECK

M.J. Patricia Harley
Dr. Peggy Walton

Abstract

"Beyond Spellcheck" is designed to demonstrate current word processing techniques in WordPerfect applicable across all academic disciplines, and to provide opportunities for participants to practice these techniques during the session. Given this design, our assumption is that computer are useful and available tools which can east the writing process. Our intended audience is person who is able to compose, create, edit, spellcheck and print a file.

There are word processing operations that assist novice and mature writers in the pre-writing process, in the drafting process and in the revising and editing process. How might the computer assist a person who is freewriting? Who fears losing a good idea? Who is at a loss for a synonym? Who wants to fay her sentence structure? Or, who is aware of using sentence fragments in her writing? These are among the topics we will address in this workshop.

"Beyond Spellcheck" is a workshop exemplifying writing across the curriculum, integrating a technical discipline with all of the disciplines. Its relevance lies in its transfer of learning: proficiency in a technical area enhances performance and learning in all other academic area. Lack of proficiency in word processing

handicaps students in all majors. This workshop is designed to overcome that handicap.

M.J. Patricia Harley, Assistant Professor, Computer Systems, Howard Community College, Columbia, MD 21044

Peggy Walton, Ph.D., Associate Professor of English, Howard Community College, Columbia, MD 21044

WELCOME
TO

BEYOND SPELLCHECK

Presenters

- Peggy Walton - Associate Professor of English and Experiential Learning
  Phone 992-4800 x4615
- M. J. Patricia Harley, Assistant Professor of Computer Systems
  Phone 992-4869

Objectives of Workshop

- To identify features of WP that can be used as tools to enhance the writing process
- To practice using several of these features
- To have participants share other experiences and techniques

Format and Mechanics

- WP means both word processing and WordPerfect
- Features will be similar on any major WP
- Happy to discuss technical differences of different versions
- This workshop was prepared using PowerPoint

Technique - MACROS

- Locate grammatical errors by isolating sentences
  - Sentence fragments
  - Run on sentences
- Examine maturity of writing
  - Sentence length
  - Sentence complexity

Practice - MACROS

- Retrieve file called FRAGS.AFT
- Run macro by holding down ALT and tapping S
- Examine each sentence
  - Is it a complete idea?
  - Is one idea running into another?

Procedure - MACROS

- Define and plan the task
- Press CTRL-F10
- Name the macro (usually ALT and a letter)
- Enter brief description
- Perform the task
- Press CTRL-F10 to end recording
- Test macro

Practice - MACROS

- Retrieve the file called GRAPH
- Create a macro
  - Press CTRL-F10; name is ALT-G
  - Description is TO SHOW STRUCTURE
  - ALT-F2, N, . , F2, ENTER, F2
  - Press SHIFT-F7, 6, 3 to view the results
  - Press CTRL-F10 to stop recording the macro
- Do not save the document
- Test the macro by clearing the screen, retrieving the file again, and executing the macro.

Technique - SEARCH FOR PROBLEM WORDS

- Homonyms - to, two, too
- Incorrect word selection - idea vs ideal, survey vs surgery, affect vs effect
- Technical correctness - disk storage vs memory, field/record/file

Procedure - SEARCH

- Move to top of document (Home, Home, UP)
- Press F2 Search key
- Type in the word you want to search for
- Press F2 to begin search
- Press F2 twice to repeat the same search

Practice - SEARCH

- Retrieve the SEARCH.AFT file
- Press F2
- Type in the word "too" (If you use lower case it will find both upper and lower case; upper case will find only upper case.)
- Press F2 to start the search

Other uses for Search

- Place marks ** or zzz to show where you want to return
  - Increase fluency
  - Substitute for "lost" words
  - Add more details later
  - Check a fact
- Serve as a manual thesaurus to check for duplicate words
- Search and replace for long phrases in a research paper

Technique - BLOCK and MOVE

- Assist with editing
- Correct the sequence of ideas
- Practice sequential logic

Procedure - BLOCK and MOVE

- Position cursor
- Press ALT-F4 to turn BLOCK o
- Paint or select text with arrows
- Press CTRL-F4, choose 1 or B, then 1or M
- Move cursor to desired location
- Press ENTER to paste down the text

Practice - BLOCK and MOVE

- Retrieve the file called SEQUENCE
- Re-arrange the sentences in a chronological sequence

Technique - INVISIBLE FREEWRITING

- Generate ideas
- Warm-up
- Review
- Prime the pump for discussion

Procedure - INVISIBLE FREEWRITING

- Invoke the word processor
- Turn off the screen
- Read the prompt
- Set the timer for 4 minutes
- Write continuously - if stuck write "I'm stuck" repeatedly until inspiration strikes
- Turn on screen to read text when bell rings

Practice - INVISIBLE FREEWRITING

- Choose one of the topics below

Composing using a WP

or

Schlepping through ice and snow

Technique - COMMENTS

- Assist with editing by temporarily "removing" text that may be extraneous
- Provide feedback on students' work in electronic form
- Write notes to oneself
- NOTE: comments will not print but can be viewed on the screen

Procedure - COMMENTS

- Move to the beginning of a block of text that may be extraneous
- Press ALT-F4 to turn on block
- Use arrows to mark the block
- Press CTRL-F5 for comment
- Answer Y to the yes/no prompt

Practice - COMMENTS

- Use the text from freewriting
- Select and block a piece of text to be temporarily removed
- Press CTRL-F5, Y to create a comment
- Press CTRL-F5, 4 or C, 3 or T to "un-comment" text

Procedure - COMMENTS 2

- Create a comment
  - Press CTRL-F%
  - Press 4 or C for comment
  - Press 1 or C for create
  - Enter the text you want in the comment
  - Press F7 to exit the comment
- "Un-comment"
  - Move cursor below comment
  - Press 4 or C for comment
  - Press 3 or T to convert to text

Questions ?

Ideas ?

GIVE STUDY SKILLS THE CREDIT THEY DESERVE

Too often Study Skills are either not taught in the Community College or they are not granted the academic credit they deserve. Researching catalog from four year colleges indicated that it is not uncommon for a range of credit to be given for study skills courses. At Essex Community College, seven courses award academic credit in the study skills area. I wish to encourage you to pick up the course proposals for these seven courses. You will be able to adapt them to your campus and thus enhance your offerings.

The presenter is Ken Bourn who has helped develop these courses over the last twenty-five years.

Remember to pick up the course proposals as you attend this session.

It is not uncommon for four year colleges and universities to award elective credit for courses designed to develop effective learning skills. A review of the catalogs of transfer institutions on the shelves in the Counseling Center at Essex Community College reveal the following information.

Kent State University printed this stand on Necessary Study Skills.

> College presents students with a series of new academic demands, and the development of good study skills is essential in meeting these demands. Because more material is covered during each class and more out-of-class work is required in college than in high school, well-developed reading and organizational skills are imperative.
>
> College students are responsible for much reading material that professors do not discuss in class. Lectures tend to supplement rather than explain the assigned reading. Therefore, students must read at a rapid enough rate to complete lengthy reading assignments and must be able to digest and organize this material. In the classroom, students need to develop note-taking skills so that lectures may be organized according to the most important points. Successful students find that carefully taken notes are essential to the learning process and to high achievement in college. Self-discipline and time management must also be practiced if academic success is to be achieved.
>
> Such study skills are basic, but many students still find it necessary to devote considerable time and energy to improving these skills. Once they are refined, however, these skills are useful in every course in every field and, later, in pursuing a successful career.

Elective credit for courses in study skills varies from one to six with some universities offering a sliding scale of more credit for more hours. The mode is three graduation credits. Institutions in this situation include the following:

Boise State University
Central Connectict State University
South Carolina State University
Johnson and Wales University
Marshall University
Utica College of Syracuse University
University of Wisconsin at La Cross
Pace University

Suffolk College
Southern Connecticute State University
University of Arkansas in Little Rock
Southern Arkansas University
Rockhurst College
Ashland University of Ohio
University of Central Oklahoma
University of Wisconsin at White Water
Baldwin-Wallace
West Chester University
University of Wisconsin at Oshkusk
Ventura College
Murry State University
Pennsylvania State University
Milwaukee Area Technical College
Phoenix College
University of Delaware
Northern Illinois University
Mississippi State University
Delta State University
Virginia Commonwealth
Lincoln University
Chicago State University
Grinnell
Northland College
Rider College
Bakersfield College

Elective credit for courses in Spelling varies from one to four with some universities offering a sliding scale of more credit for more hours. The mode is two graduation credits. Institutions in this situation include the following:

San Bernardino Valley College
Ventura College
Murry State University
Central Arizona University
Phoenix College
University of Central Oklahoma

Elective credit for courses in Critical Reading varies from one to three. The mode is three graduation credits. Institutions in this situation include the following:

Central Arizona University
Pennsylvania State University
San Berardino Valley College
Phoenix College
University of Delaware
Northern Illinois University
Northeast Louisiana University
Mississippi State University
Virginia Commonwealth University
Lincoln University
Chicago State University
Northland College
Adams State College
Bakersfield College

Utica College of Syracuse University
Cornell
Rockhurst College

Elective credit for courses in Memory varies from one to three. The mode is three graduation credits. Institutions in this situation include the following:

Grinnell
University of Arkansas in Little Rock
University of Wisconsin at White Water
San Bernardino Valley College
West Chester University

Elective credit for courses in Vocabulary varies from one to six with some universities offering a sliding scale of more credit for more hours. The mode is three graduation credits. Institutions in this situation include the following:

Utica College of Syracuse University
University of Wisconsin at La Cross
Cornell
Pace University
Suffolk College
Southern Connecticut State University
University of Arkansas in Little Rock
Southern Arkansas University
Ashland University
San Berardino Valley College
Murry State University
Central Arizona
Pennsylvania State University
Milwaukee Area Technical College
Phoenix College
Northeast Louisiana University
Delta State University
Virginia Commonwealth University
Chicago State University
Grinnell
Western Illinois University
Troy State University
Bakersfield College
Iowa State University
Centeral Connecticut State University
South Carolina State College
Johnson and Wales

Elective credit for courses in Listening varies from one to six with some universities offering a sliding scale of more credit for more hours. The mode is three graduation credits. Institutions in this situation include the following:

University of Wisconsin at White Water
San Bernadino Valley College
Southern Arkansas University
Central Arizona
University of Wisconsin at La Cross
Milwaukee Area Technical College
Boise State University
Marshall University

Elective credit for courses in Rapid Reading varies from one to six with some universities offering a sliding scale of more credit for more hours. The mode is three graduation credits. Institutions in this situation include the following:

Iowa State University
Centeral Connecticut State University
South Carolina State University
Johnson and Wales University
Marshall University
University of Wisconsin at La Cross
Cornell
Pace University
Southern Connecticute State University
University of Arkansas in Little Rock
Southern Arkansas University
University of Central Oklahoma
University of Wisconsin at Oshkush
San Bernardino Valley College
Ventura College
Murry State University
Central Arizona University
Phoenix College
Northern Illinois University
Northeast Louisiana University
Mississippi State University
Delta State University
Lincoln University
University of Maine at Augusta
Chicago State University
Grinnell
Western Illinois University
Troy State University
Northland College
Rider College
Adams State College
Bakersfield College

Nineteen other four year colleges and universities indicated that they have study skill courses for academic credit but did not identify the amount of credit awarded.

TRANSFERABILITY OF READING COURSES

Coppin State University, Frostburg State University and the University of Baltimore accept as elective credit the following courses:

Reading 140 Spelling Development
Reading 141 Rapid Reading
Reading 144 Vocabulary Development
Reading 150 How to Study
Reading 154 Memory Development
Reading 156 College Listening and Notetaking Skills

The University of Maryland in College Park also accepts as an elective credit the following courses:

Reading 150 How to Study
Reading 154 Memory Development