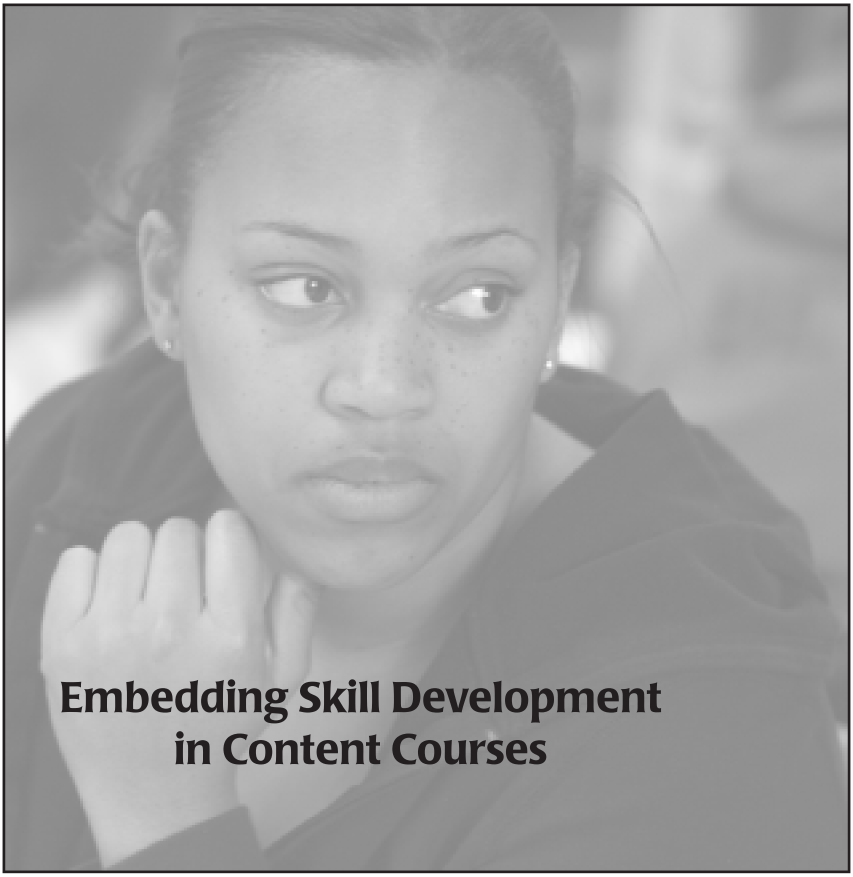

Embedding Skill Development in Content Courses

Embedding Skill Development in Content Courses

Introduction

This section begins with a chapter by history professors David Arendale and David Ghere. They focus on the teaching of an introductory history course that embeds skill development and learning directly within the content of their classes. Traditionally, disciplines like history, art, social science, and philosophy, for some examples, are not typically taught with an overt emphasis on student development the way that the subjects of math, reading, and writing have been discussed in the fields of higher education, learning assistance, and developmental education. By identifying how to incorporate learning strategies and student support more directly within the framework of a course like American History, Arendale and Ghere note how developmental education is effective in all the content areas for increasing student achievement and engagement.

The next chapter in this section is by Pat James, who chronicles the rich history of the arts as part of the GC curriculum and the role that art can have in the development of skills that are easily transferable to other college courses and to life in general. James describes how the arts are incorporated into GC courses in myriad forms. She then goes into greater depth in illustrating her own teaching methods and how they are perceived through the reflective writing of "Risa," a former student.

The GC math program is another part of the curriculum that serves a diverse range of students each year. Kinney, Robertson, and Kinney discuss the multiple models for math courses that are offered to GC students, depending on their preference. This includes lecture, computer-mediated instruction, group-guided discovery, active learning with a mastery approach, and cooperative learning. This array of approaches that are available to GC students acknowledges the range of learning styles and student needs to engage with real-world concepts and mathematical equations.

Kinney, Kinney, and Robertson follow up with another chapter specifically on the computer-mediated instructional model in General College. This type of approach to math instruction includes assessment of students, student feedback, use of the latest software available for instruction, and analysis of learning outcomes that can be tracked with the software itself. Students who self-select into the computer-mediated courses may prefer using technology as a tool for engagement and improvement of their math skills.

Carl Chung is very successful in making symbolic logic accessible and meaningful to General College students by integrating course content and basic skill development. Chung insists that "creating a learning environment that enables skill acquisition and development is as important as teaching the skills themselves." He also articulates the importance of offering symbolic logic as an alternative to traditional developmental mathematics courses because it allows students who have had negative experiences with math to start with a "clean slate" while also enabling students to "ground the symbols and symbolic manipulations" in their knowledge of language, "which is familiar to them, . . . [while] logic is not."

In his chapter, Leon Hsu presents a detailed description of his implementation of a "Physics by Inquiry" course that focuses on the development of critical and metacognitive thinking skills. Students learn in small groups by developing, testing, and evaluating scientific theories to predict real-world phenomena. Hsu notes that the course "cannot address as many different topics as a 'mile-wide, inch deep' survey course for non-science majors" but instead fosters scientific thinking that will be transferable to other settings.

Heidi Barajas and Walt Jacobs apply the concepts of Universal Design of Learning (UDL) to teaching sociology, with an emphasis on the sociological imagination. They begin their chapter by identifying similarities between the concepts and principles of UDL and the definition and goals of developmental education. They discuss "understanding the theoretical implications of treating all students as developing sociologists, able to identify their own social location in a historical as well as biographical context." Barajas and Jacobs also remind us that social status, like educational achievement, is not merely the result of hard work, but may also be "either constrained or facilitated by social group membership." They illustrate their points through the description of service learning and storytelling as powerful pedagogy.

CHAPTER 12

Integrating Best Practices of Developmental Education in Introductory History Courses

David R. Arendale and David L. Ghere

ABSTRACT

This chapter provides a practical model for social science teachers to integrate the best practices of developmental education within a course. The approach requires systemic changes in the learning environment that facilitate both higher educational outcomes and concurrent development of lifelong learning skills among all students. This new model stands in contrast with the traditional developmental education approach that identifies individual students within a class based on predictive measures and prescribes specific activities for them alone. This chapter's narrative identifies practices used by the authors successfully with their college students in introductory courses in American history and world history.

Higher education at a major research university and best teaching practices are not mutually exclusive. The mission of the General College (GC) at the University of Minnesota requires instructors to be innovative and varied in their teaching methodology while systematically embedding academic skill development into freshman-level courses. GC courses retain the rigorous content standards and high performance expectations of college-level courses while integrating activities and assignments that enhance the student's ability to perform college-level work. The accomplishment of this goal requires a thoughtful and creative approach to course design, including the revision of course procedures, classroom activities, written assignments, evaluation methods, and feedback to students. This chapter explores the experience and practice of the authors in teaching history at GC and provides a practical model as well as specific methods for incorporating the best practices of developmental education into other social science courses.

Statement of the Problem and Challenge

History teachers operate with multiple learning goals for their courses due to the complexity of the subject material, their own expectations for the course, and the standards of the education community. The following goals are just a few of the more traditional ones found in college history courses: (a) identification of the themes, concepts, and influences central to the time period studied; (b) formation of connections between historical events and personal interests; (c) development of intellectual skills of analysis, synthesis, critical evaluation, and application; and (d) development of an informed historical perspective and greater awareness of and respect for individual, cultural, ethnic, and religious differences. However, changes in the educational environment may require an expansion of these learning objectives for diverse student populations, particularly in introductory core curriculum courses.

Access to postsecondary education has increased due to a variety of factors including the increase in local postsecondary institutions and the availability of financial aid. As access has widened, more students are pursuing postsecondary education, including students who are first-generation to college and from historically-underrepresented groups (Kipp, Price, & Wohlford, 2002). History teachers and their institutions are faced with both maintaining high academic standards and increasing student success regarding outcomes such as mastery of course content material, reenrollment rates, persistence in the academic major, scores on junior- and senior-level examinations, and graduation rates. Nearly all entering students at GC are academically underprepared and share common traits with students who have developmental needs. Many of these students need a different educational experience to meet their learning needs than has been traditionally offered in the past by other institutions following the traditional approach to developmental education. GC provides an enriched learning environment for all students enrolled in the class rather than expecting individual students to seek help elsewhere. We believe that the classroom must be a seamless integration of both teaching and learning mastery with the professor as a catalyst for both.

With the growing diversity of college applicants, radical changes are required in postsecondary education to help it adapt to the needs of students rather than continuing the common practice of demanding students to conform to an arbitrary standard established by the institution. Despite the wide variety of academic interventions designed and implemented in the past 20 years, persistence and graduation rates have not changed significantly based on a national survey of institutions of various types in the U.S. (American

College Testing Program, 2003a). In a recent national study of 2,419 postsecondary institutions of various types, the mean graduation rate was 45% (American College Testing Program, 2003b). Tinto (1993) reported that the average national dropout rate from college has remained at 50% for the past 100 years in American higher education.

This mismatch between institutional expectations and initial student capabilities and preferences is further challenged by changes in the availability of traditional developmental education activities such as study skills courses, reading courses, workshops, and the like. Nationwide studies suggest that these traditional forms of academic enrichment and development for students are becoming less available and have even been eliminated at some institutional types depending on the state (Bastedo & Gumport, 2003; Boylan, Saxon, & Boylan, 2002; Martinez, Snider, & Day, 2003; Shaw, 1997; Stratton, 1998). This elimination of developmental education support has been noted at public 4-year institutions, especially at research institutions (Barefoot, 2003; Jehangir, 2002; Moore, Jensen, & Hatch, 2002; Yaffe, 1998). Rather than decrying the reduced availability of previous forms of developmental education, American postsecondary education has the opportunity to reinvent the learning environment through mainstreaming of academic assistance and enrichment within all classrooms. GC has been an ongoing experiment toward this goal since its creation in 1932.

Concurrent development of learning strategies while enrolled in an introductory core curriculum course such as history is a viable alternative to requiring students to enroll in separate developmental education courses. This requires a reengineering of the course to permit an expansion of purpose. In addition to the traditional content-specific learning objectives, a new one is added: acquisition of strategic learning strategies to master the course material. Other authors have presented models for such integration (Cruthird, 1986; Francisco, Trautmann, & Nicoll, 1998; Luvaas-Briggs, 1984). Building on previous scholarship concerning integration of strategies within a history course (Ghere, 2000; 2001; 2003; Wilcox, delMas, Stewart, Johnson, & Ghere, 1997), this chapter offers practical suggestions that instructors could implement in a wide variety of courses.

Regardless of their academic need, few GC students are interested in separate instruction in study skills, reading strategies, and so on. With the institution's recent emphasis on students completing their undergraduate degrees within 4 years, there is even less perceived flexibility for students to enroll in additional courses outside of their obligations of core requirements and prescribed degree programs. From our perspective, acquisition of lifelong learning skills must be within the context of the history course content material. Research suggests that the learning strategy must be directly applicable to learning the academic content material so students perceive that they will earn higher grades on the major examinations (Bohr, 1994; Kerr, 1993; Stahl, Simpson, & Hayes, 1992). Although we take a much longer view of the utility of learning strategies for lifelong learning, that view must be balanced by immediate application to learning demands perceived by students and short-term potential gratification through higher exam scores. This balancing of needs by both instructors and students is a constantly negotiated relationship concerning the choice of classroom activities and academic content material.

Educational Theory Supporting Embedded Developmental Education

Current studies report that nearly one third of all entering first-year students enroll in one or more developmental courses. This rate has not varied for many decades (Parsad & Lewis, 2003). This enrollment rate severely underreports the number of students with academic development needs. This occurs because it does not include students who enroll in developmental courses later in their college career nor does it indicate which students participate in noncredit academic enrichment activities such as individual or group tutoring like the Emerging Scholars Program (Treisman, 1985), Supplemental Instruction (Arendale, 1998), attendance at study skills workshops, and other activities and programs designed to increase student academic achievement.

The literature has frequently cited the use of linked courses (Gabelnick, MacGregor, Matthews, & Smith, 1990; Malnarich with Others, 2003; Tinto, 1997) as an effective means for accomplishing this goal. An example would be a study skills course linked with an introductory sociology course. In this model, student motivation to acquire academic skills and develop learning strategies is enhanced by its immediate application to the course and its positive effect on the course grade. While some institutions report success with this model, other institutions do not have the option since such study skills courses have been eliminated from the curriculum. In addition, this method still targets a specified subpopulation of students and does not place the institution in the leadership role of systemically changing the learning environment for all students.

The integrated and embedded approach to developmental education is based upon the following premises:

1. The development of mastery of core curriculum knowledge or skills and lifelong learning skills is most effective when accomplished concurrently.

2. The institution must adapt itself to the entering student population rather than expecting students to adopt the behaviors of the dominant culture.

3. Students with a disability are best served when mainstreamed with all students within the classroom.

4. Activities and services originally designed to meet the needs of developmental education and those with a disability often have high utility for all students within the class.

The educational practices contained within this chapter were selected first because of their grounding in educational theory and second for their utility within the classroom. Research studies suggest that most college students have extreme difficulty in applying principles learned from isolated study skills instruction, reading courses, and similar kinds of approaches with their core curriculum courses (Stahl, Simpson, & Hayes, 1992). This research suggested that students acquire and incorporate learning and study strategies most effectively when they concurrently apply them in the context of a content course. The concept of "situated cognition" states that more effective learning takes place within a context that is both personally meaningful and requires the student to make direct application of a new cognitive skill that has been recently taught (Wilson, 1993). New abstract ideas and skills are immediately grounded in concrete use with a learning task and an educational outcome measure. Immediate application and positive feedback concerning successful use of the skill increase the likelihood of further use.

In addition to the need to embed practice with learning strategies within the content classroom, students must gain more awareness of their own learning process. Their learning effectiveness is increased through development of metacognitive processes that allow them to self-monitor their comprehension level and then make changes in their study strategies to meet the learning task need. In addition to understanding the cognitive needs of the tasks, it is also essential for both students and classroom instructors to discover, understand, and deal with the impact of various facets of student motivation (Pintrich, 2000).

Associated with this concept of concurrent development of learning strategies is the concept of Universal Instructional Design (UID; Higbee, 2003). Although originally conceptualized as a transformation of the classroom environment for mainstreaming of students with disabilities (Silver, Bourke, & Strehorn, 1998), the approach has been extended for the transformation of the classroom experience to increase learning and outcomes for all students. This includes students who are academically underprepared and are mainstreamed into traditional, first-year college courses that present rigorous academic content and skills (Higbee). Practices that are helpful to developmental or disability needs have proven to be helpful for the entire student body because they contribute to an enriched environment. This paradigm requires the institution to present a transformed learning environment that capitalizes on existing student strengths and builds upon them throughout the course.

Finally, it is recognized that most students learn best as a member of a cohort of peers. The unique traits of students—demographic, cultural, intellectual—are important ingredients and resources for their learning experiences. In this sociocultural perspective, the education enterprise is viewed as a learning community dependent upon the active participation of all members (Vygotsky, 1978). Various educational activities associated with the course encourage extensive student dialogue, various ways to express mastery of academic content and demonstration of acquired skills, and small peer-group cooperative learning activities.

Teaching in a developmental context requires strategies that promote the student's success in GC. Because of the predominant background of GC students as first-generation college attenders, it is incumbent upon us as course professors throughout the academic term to model our thinking process concerning the academic content material and the various learning strategies that students can employ for more deeply mastering the material. We "make explicit the implicit" demands of the course and model ways to more deeply understand and appreciate the academic content.

Teaching in a developmental context also requires strategies that promote the student's successful transition to the greater university. Professors employ use of psychological "fading" strategies (Dembo, 1994, p. 56; Renkl, Atkinson, & Maier, 2000, pp. 1–6) to gradually withdraw the structural elements of the course (e.g., providing detailed advance organizers, PowerPoint slides, reminders of course requirements) to allow students to assume more responsibility for such matters by the end of the course. This practice facilitates the time of transition to new courses the following academic term that may not have the same type of embedded developmental education strategies.

Overview of the General College Introductory History Courses

GC has implemented this integrated and embedded approach to developmental education. In addition to seeking to meet individual course and content objectives, all courses offered in General College contain the following four objectives: (a) to develop student academic skills in writing and creative thinking; (b) to assist students in developing good academic habits; (c) to use innovative teaching methods and relate class topics to current issues; and (d) to increase the frequency and vary the method of assessment and feedback. These goals have been successfully implemented in Survey of U.S. History (GC 1231), a one-semester survey of American History, and World Civilization Since 1500 (GC 1251), through utilization of a variety of developmental course activities. Both classes enroll from 35 to 45 students per section to facilitate active learning methods, enhance student-instructor interaction, and promote fruitful class discussions. However, the basic concepts and teaching methods could be adapted to a wide variety of social science courses.

GC 1231 has been designated as a writing-intensive course by the University. These courses are designed to develop the students' writing ability, particularly in research papers, beyond the level provided by the required freshman-level composition courses. Students must successfully pass four writing-intensive courses in order to graduate. In GC 1231 students need to complete three different types of writing assignments: (a) short five- to seven-sentence essays in the form of 11 in-class writings and six questions on each of three exams, (b) a long essay question on each of three major exams, and (c) a 10- to 12-page formal paper. Because the course is writing intensive, a graduate teaching assistant (GTA) is available to critique and grade the homework assignments and provide a detailed critique of the first draft of the formal paper. The instructor grades all the long essays and the final draft of the paper.

GC 1251 meets two of the liberal education requirements for graduation from the University: Historical Perspectives and International Perspectives. A variety of writing venues are provided throughout the course, although not to the same intensity as in the American history course that has been designated as writing intensive. The first of the writing components is completing three essay questions on each of the four major exams. Six potential essay questions are identified for each exam on a study guide distributed at the beginning of each new unit. Four questions are provided on each exam, with students given the choice of completing three of them. A short paper of one to two pages is required concerning a "field trip" to a historically-related event or film from a list provided by the course instructor. Finally, eight short in-class writing assignments occur during class sessions to allow students to summarize major components of course material or to reflect on historical topics and their relationship to contemporary events. Because of the class size and course expectations, an undergraduate teaching assistant (UGTA) facilitates optional study review sessions outside of class 3 days per week. These sessions are called Excel Learning Groups (ELGs) and follow similar procedures as other peer cooperative learning programs such as the Emerging Scholars Program (Treisman, 1985), Peer-Led Team Learning (Dreyfus, 2004), Structured Learning Assistance (Doyle & Kowalczyk, 1999), and Supplemental Instruction (Arendale, 1998).

Modifications of the Classroom Learning Environment

Following is a sample of the activities and modifications to the classroom learning environment for either or both the American history and world history courses. To permit time for mastery of lifelong learning skills in addition to the traditional curriculum expectations and requirements, the course has been expanded from three to four semester credit hours.

Concurrent Development and Content Mastery

In the American history course students are expected each week to answer one homework question by composing a paragraph of six or seven sentences. These questions are constructed so that the answer cannot simply be copied from the text and are of two basic types. The first type requires students to identify key points or summarize events from a two- to three-page section of the text. This ability to recognize the key points in a piece of text and condense the information into a short concise paragraph will be invaluable to students throughout their lives. The second type of question asks students to assume a particular role given the background information from the assigned reading and reflect on what their actions or decisions would be in that situation. For example,

1. Why did the 13th, 14th, and 15th Amendments to the U.S. Constitution fail to secure equality for the ex-slaves? (examples: court decisions, state legislation, and violence)

2. Would you prefer to be a woman in colonial New England or colonial Virginia? Why? (examples: health concerns, property rights, social issues)

These writing exercises gradually enhance the students' organization and analysis skills, as well as their critical thinking and creativity.

American history students take three major exams during the academic term, each including a question to be answered in a lengthy essay encompassing four to eight pages in a test booklet (i.e., "blue book"). Essay questions focus on broad themes that require students to consolidate and compare information and ideas over the span of a historical period. Essay questions are announced one week in advance of the exam so students can organize their thoughts and look for evidence to support their arguments. This practice not only develops the students' writing skills, but it also enables the instructor to have much higher expectations about the preparation for the essay and the quality of the arguments. Poor performance can be dealt with appropriately because the problem, whether the students' lack of understanding or lack of motivation to study, can be more easily determined. Essays are written in class without notes, and the bluebooks are marked to prevent students from bringing a previously written essay into class.

Implementation of Universal Instructional Design

Universal Instructional Design is an approach to education in which systemic changes are made to the learning environment to accommodate the needs of students with a disability (Higbee, 2003). There has been considerable debate within education at the elementary, secondary, and postsecondary levels about the mainstreaming of these students. Through this spirited dialogue and review of educational outcomes, it has been clearly demonstrated that all students within the classroom benefit from these changes, which increase the accessibility of knowledge and the environment in which learning activities occur. These changes in environment can be especially useful for students who have issues related to academic underpreparedness. Following are a number of activities and modifications to the classroom directly related to UID for use in both the American history and world history courses. Throughout the rest of this chapter are other activities and modifications that could also be considered UID adaptations, but they have been placed under other categories for the sake of clarity for the reader.

Web-based access to knowledge. Accessing course-related materials, whether created by the instructor or provided by the textbook publisher, provides an opportunity for the student to study and practice with the material in privacy and to decide how much time to invest in the activity. Syllabi, course calendars, assignment guidelines, review sheets, topic outlines, and discussion questions can all be placed on the Web site as well as links to documents, maps, charts, images, resource sites, and PowerPoint lecture slides. Students with a disability can more easily use the material through text readers, enlarged print, and other adaptive technology. All students have an opportunity to be better prepared for class sessions and to be more confident in participating in small group and class-wide discussions.

Assessment of knowledge. Our purpose is to assess the student's knowledge and understanding of the course material, not the speed with which the students can compose their thoughts in written essays. Tests with time limits advantage the free-flowing writer and disadvantage the meticulous writer while imposing unnecessary limits on the student's demonstration of course content mastery. In both the American and world history courses, tests are designed to require 60 to 75 minutes, but at the end of the 2-hour class session students are allowed to finish their work in the professor's office. A few students request this provision each term. Generally accommodation for students with learning disabilities (usually time-and-a-half on tests) is not needed because all students have the time necessary to fully convey their comprehension of the course material. However, one or two students each term are approved by the institution's Disability Services—a unit of the Office of Multicultural & Academic Affairs—to take their exams in their office to provide an isolated environment for those who may become distracted by others in the room.

The provision of additional time benefits all students. It helps alleviate one source of test anxiety by eliminating time pressure. It helps students in being more reflective about taking the exam, more careful in reading exam questions, more practiced in writing short outlines for essay questions, and more proficient in gathering information from the vocabulary and multiple-choice sections of the exam that could be useful for supporting the essay question responses. Expectations can be raised by the instructor because students will have the time needed to create more reflective and analytical responses to essay questions. When quality work is not produced, the reason for the failure, whether lack of ability or lack of effort, is more apparent and the appropriate solutions more obvious to both instructor and student.

Preparation for lectures and learning. A challenge for some students is the difficulty of navigating a rich, fast-moving, and sometimes complicated college classroom learning environment. This pace contrasts with the more common public high school experience that is much slower, structured, teacher-directed, and that assigns time during class for silent reading of the textbook because there are insufficient copies for checkout to all students. In this case, students do not acquire the habit of advance reading of upcoming textbook chapters because the books are unavailable for home checkout.

Providing lecture outlines ahead of time or hiring a fellow student to provide copies of notes is not an uncommon practice for some students with a disability because of their challenge with the expectations of the college learning environment. The introduction of PowerPoint slide presentations to accompany class lectures has accentuated this problem for more students within the class because the amount of content information presented is often larger and moves at a faster pace.

In the world history course the instructor provides an incomplete copy of the upcoming PowerPoint lecture slides ahead of time for each student. The slides are sent via the course e-mail list in the PowerPoint handout format, which includes three slides on the left side of the page with the right side of the page blank for the addition of student notes. Students do not need the PowerPoint software installed on the computer because the document is sent in Acrobat PDF format. Each email message also provides a Web link to information for downloading a free software copy of the PDF reader. Several other academic units on campus, including the business and law schools, also send similar handouts via e-mail to students. However, the difference with the world history slides is that they are abridged. Common elements that are deleted include secondary or tertiary points on the text slides and all maps, art work, or slides that prompt students within the class session for small group activities, reading activities, class announcements, and so forth. For students with a documented disability, the complete set of PowerPoint slides with all secondary or tertiary points is provided ahead of time. Last academic term a student with a severe sight impairment was able to use this complete set of slides on his computer in advance of the class lecture. Using the PowerPoint software program, he first converted the slides into the outline view and then used the adaptive software installed on his computer to convert the written outline into an audio narration of the complete slides.

One purpose of providing the incomplete slides in advance is to encourage students to focus on conceptual understanding and application rather than rote lecture note-taking. The incomplete notes relieve students from spending time during lecture segments rapidly taking notes. Rather, students listen, reflect, question, and then annotate their notes on the basis of the class discussion and the secondary and tertiary information on the PowerPoint slides presented by the course instructor that did not appear on the slides sent to the students earlier.

Another benefit of use of PowerPoint slides with the students is that it also prepares them for a pedagogy and a technology that, good or bad, is widely implemented throughout the University. As the term progresses, the instructor begins to fade the detail level of the PowerPoint slides. The goal is to enable the students to acquire more information through the oral comments of the instructor and fellow students and not to be completely dependent upon the PowerPoint slides to determine what content is most important and to master the course topics.

A cautionary note with providing the slides ahead of time, either by e-mail attachment or by placement on a Web site, revolves around the maturity level of some first-year students. In the first semester that the world history teacher provided the PowerPoint slides to the students, he provided the complete set of notes. Class attendance fell quickly. The instructor postulated that some of these students made the assumption that all that occurred within the lecture was contained in the PowerPoint slides displayed in class. It appeared that this same phenomenon did not occur to the same extent in the upper division and graduate courses on campus. When the instructor changed the format of the advance slides and made them incomplete, attendance rose in the class.

Valuing Course Materials

Students sometimes act on the maxim that the amount of time that an instructor spends on an issue in class is related to its overall relative importance. Students are not easily convinced when the instructor states something is important and then fails to mention it again in the course. This mismatch of expectations is especially profound regarding the use of the course syllabus, textbook, ancillary course materials, and associated Web-based resources. Although the first day of class is often uplifting for the course professor, it can be very intimidating for college students, regardless of their academic preparation level. In psychology a term that relates to this circumstance is "felt necessity" (Boekaertis & Niemivirta, 2000, pp. 419–421). People are more likely to remember information when it is immediately applicable, necessary, and needed by the individual. Reminding students about course tutors, course assignments, and textbook features before they have engaged the material has important, though limited, value. Instructors need to value such materials and procedures throughout the course term so that students emotionally understand that the material is important, relevant, and meets their learning needs (Martin, Blanc, & Arendale, 1994).

The course syllabus. Instructors often spend large amounts of time carefully crafting course syllabus documents and then quickly rushing through them on the first day of class so that the first lecture can be delivered. From an instructor's point of view it might seem reasonable to instruct students by telling them to read the syllabus on their own. The message received by students is that they have received another official university document, nearly incomprehensible as well as irrelevant to an anxious first-year student. Rather than seeing it as a tool to use continually throughout the term, it is dutifully filed or recycled. In both the American and world history classes the instructors bring the syllabus daily to class and frequently consult it in front of class when questions arise about assignments, due dates, grading criteria, or all the other issues that have been carefully addressed.

The required course textbook. The same comments also apply to the textbook. In the world history course on the first day of class the instructor takes an extended tour of the textbook and notes the important components that are sometimes overlooked: (a) table of contents that provides outlines of each chapter, (b) study questions and key vocabulary words at the beginning or end of the chapter, (c) glossary in the back of the book useful for defining key vocabulary terms in the exam study guides, and (d) an index in the back of the book useful for looking up topics or key vocabulary terms in the exam study guide. Parts of these pages have been scanned into the computer and then incorporated into a PowerPoint presentation to make it easier for students to note the features, especially for those students who have delayed purchasing their textbook due to the perception that such expenditures may be unnecessary.

In both the American and world history courses, textbooks are valued continually throughout the academic term by the course instructor in a variety of ways. First, the instructor always brings the textbook with him to class each day and finds ways to refer to material on specific pages. Examples for use of the textbook include drawing attention to specific questions listed in the chapter overview designed to guide the reading; moderating discussion concerning the meaning of maps, charts, illustrations, or brief historical primary documents in the book that are sometimes overlooked by the reader; illustrating the utility of the glossary or index in the back of the book to quickly locate information; or other activities. At least once each week students are required during class to work in groups of two or three to read a short passage or study an image, answer a question posed by the instructor in their small group, and then share during a large group session. The purpose of this activity is to learn from each other how to break down textbook material, develop confidence that they can effectively understand new material, and notice features that the textbook provides to deepen understanding of the material (e.g., chapter summaries, questions, coordinated images, key terms, bolded print, glossary, index, subheadings). To assist students in seeing how the teacher reads and interprets the material, one page from each chapter is provided to the students during class. On this textbook page, selected for being especially rich in content material that may appear on the exam, the instructor underlines key phrases and writes short comments in the margin area. To provide more space for the notes, the photocopy of the original textbook page is reduced to 75%. This process reveals the valuing system that the instructor employs when reading the textbook. It also provides a model for students for how to mark up textbooks, which is seldom done in high school because the books must be used by other students in succeeding terms or even by other students during the same class day.

Web-based resources. For teachers who seek to include Web-based resources, especially those provided by the textbook publisher, it is critical to practice extensively with accessing the materials from a computer and exploring all components of the package. Sometimes the test banks are heavily focused on knowledge-level questions of material that is obscure, even for course instructors. Encouraging students to test themselves with this type of material can be demoralizing and counterproductive. Secondly, the difficulty in accessing Web-based materials can be challenging, even for experienced computer users. It is best to demonstrate the use of such Internet resources in class. It would be a mistake to assume that today's students are equally savvy concerning use of computing resources. A cautionary note about relying upon Web resources is that not all Web sites have been modified to allow their use by students with vision or hearing disabilities. In such cases the material needs to be made available in an accessible format or it should be eliminated so as not to provide an unfair advantage for some students.

Alternative Formal Assessment Measures

Although the diversity of entering students has continued to rise, the use of diverse measures for student mastery often has not changed significantly. Too often, for instance, students are expected to navigate multiple-choice examinations expertly. In addition to providing some multiple-choice questions on exams, the two history courses have employed a mix of short and long essay questions, matching exercises, short answer, and identity questions. Other formal assessment methods have included journals, short in-class or homework writing assignments, reaction papers, short and long research papers, written reviews of history Web sites, historically-related films, guest speakers, and museum exhibitions. In-class activities and student presentations can be evaluated by the instructor or assessed through peer review and self-review.

Use of Classroom Assessment Techniques

In both history courses, nongraded classroom assessment techniques (Angelo & Cross, 1993) are frequently used to build metacognitive awareness and motivation for academic behavior changes. Helping students to see the link between their behavior and grades is a difficult task. Some students, because of previous unsuccessful educational experiences, already perceive that there is no relationship between their examination preparation behaviors and the grades received. Students are provided a safe environment to discover what they do and do not know through frequent use of ungraded quiz questions, small group discussions, in-class textbook or current newspaper short reading assignments, or other means. The goal is for students not to be surprised with results from their major examinations. Sometimes this is still a surprise, so in the world history course an activity is used in class on the day that the exams are returned to students.

After the first exam in the world history course is returned to students, the instructor hands out a detailed 30-item survey for students to complete before they depart class on that day. The survey asks them to recount the exam preparation behaviors they engaged before the exam and techniques used during the exam. Students are instructed not to identify themselves on the survey except by indicating whether they scored in one of the following grade categories: AB or CDF. This activity provides an opportunity for students to reflect on their test preparation and test-taking behaviors and discover potential relationships between the behaviors and grades received on the exam. At the following class session, the instructor returns a summary of this class survey that groups responses for each of the 30 items between those who earned an A or B versus those who earned a C or lower on the exam. The summary provides feedback to the students from their peers on which behaviors were associated with those who did well and those who did not perform well on the exam. Rather than relying on the instructor to deliver an exhortation on particular behaviors, students observe their peers and hopefully will be more likely to adopt new positive behaviors. This same process is repeated after the third of the four examinations administered during the academic term.

Fostering Critical Thinking Through Simulations

A challenge for students who are academically underprepared is their preoccupation with locating "correct" information and seeking the "one" answer to questions. This narrow focus can be a barrier to the development of critical thinking skills that will be necessary in upper-division courses both to understand material and to complete course examinations successfully. Fostering the development of critical thinking skills is essential for students who are academically underprepared (Adams & Hamm, 1990; Chaffee, 1992; Higbee & Dwinell, 1998; Paul & Elder, 1999; Stone, 1990).

One way to help stimulate critical thinking skills is through the use of historical decision-making simulations. An additional benefit of this strategy is that it provides more engagement for the students because most report that they find it interesting and relevant, and they have the opportunity to work in small groups. These are just some of the many educational benefits for students from simulations (Bennett, Leibman, & Fetter, 1997; Bredemeier & Greenblat, 1981; Druckman, 1995; Randell, Morris, Welzel, & Whitehall, 1992).

All simulations involve the students in active learning situations requiring some level of role playing. These roles can be very specific as a historical individual; more general as a representative of a country, region, or state; or very generic as a decision maker assessing the historical options that might have been available. Simulations provide the background material necessary for each student to evaluate the various decision options in the historical situation and to play the role assigned. Sometimes a reward system is utilized to create a situation, which fosters competition between groups and cooperation within each group. In these "game" simulations, students articulate their position, negotiate with other students, and compromise when necessary to reach a consensus decision or political bargain that achieves their goals. Other simulations employ maps to convey information to the students, to designate various territorial options, and to ultimately display student decisions. Following are several examples of simulation activities:

1. What principles would you employ to govern a large empire that was extremely culturally diverse and geographically dispersed? This simulation is based on common experiences from the three great Muslim Empires from 1500 to 1700 that enabled them to successfully govern and expand their influence.

2. What factors would you consider as you reorganized the borders of

European countries to prevent future aggressions? This question asks students to compare and contrast the same historical scenarios experienced after three world wars: the Napoleonic Wars, World War I, and World War II.

3. As a United Nations commission, what political organization and degree of autonomy would you recommend for a specific region based on data concerning its ethnic and religious composition? Students must analyze the question based on historical events in different geographic locations of the world that encompass different cultures and traditions: West Bank, Northern Ireland, Kosovo, and Bosnia.

4. As U.S. Senators representing specific states or regions, negotiate and compromise on important legislative issues. Students must draw conclusions at different historical time periods in United States history: first session of Congress, Jacksonian Period, Compromise of 1850, and the Gilded Age.

In each case, natural interests of role playing, competitive play, and intellectual curiosity are channeled into an educational activity that helps to foster students' critical thinking skills.

Examination Preparation Strategies

Many GC students experience major problems with formal course examinations for a variety of reasons already discussed earlier in this chapter. Too many see a disassociated relationship between their behaviors and the grades received on exams. To counter this student assumption, practice with good test-taking strategies is integrated into both history classes.

Valuing material to study for the exam. Some students find it difficult to study for exams because they are unable to sort out the course content and decide what material to study more intensely. Some of these students take lecture notes much like a court stenographer, taking down everything spoken during class, but they are unable to sort, reorganize, and value the material differently. In both the American and world history courses, study guides are provided in advance to identify key vocabulary terms, potential essay questions, and topic areas for the multiple-choice questions.

Communicating what is required for the exam. Many first-year students report difficulty with the shift from secondary school test formats that emphasized multiple-choice questions to the use of essay questions more prevalent in the postsecondary environment. To help students develop in this area both history courses incorporate frequent opportunities for practice in writing essay questions during class with feedback provided by the instructor, GTA, or fellow students through peer review. Because of its writing-intensive nature described earlier in this chapter, the American history course includes more practice in this area.

Additional opportunities to practice for the exam occur through class time devoted to practice with mock examinations that emulate the style and format of the exams. Instructors help students identify key language in directions, common terms used with essay questions and their specific meanings, and methods for using one part of the exam (i.e., vocabulary matching and multiple choice) to help answer the essay and short answer questions. A handout details the recommended strategies for answering different question types: true or false, multiple choice, and essay. Other instruction regarding test-taking strategies occurs by using the frequent classroom assessment techniques as an opportunity also to analyze the strategies used for completing them.

Metacognitive learning strategies. To maximize the learning experience from the exam, the instructors return the exams to students within two class periods after the exam. The exams are debriefed with the students. During the process, the course instructor shares whether the question is based on the textbook or lecture and the key elements of the question that helped to identify the reason for selection of the correct response. Previously described in this chapter was the use of the exam survey in the world history course for students to consider their test preparation and test-taking strategies and how they might be related to the grade received on the exam.

Peer Cooperative Learning Strategies

Interactive student activities increase student engagement, build learning networks, encourage students to see one another as learning resources, and increase content mastery of challenging material (Astin, 1993; Bruffee, 1993; Cooper, Prescott, Cook, Smith, & Mueck, 1990; Light, 2001). Opportunities for peer learning are often especially important for students who may be underprepared and need to seek out peers to assist them in succeeding in academically challenging courses. Helping them to become comfortable with one another in class, even when acknowledging their ignorance of course material, is a vital step to enabling them to form their own study groups outside of class for this or other courses in their degree program. Students may be more likely to engage in dialogues with one another without the course instructor who is responsible for evaluation and assignment of final course grades.

Peer cooperative learning groups are frequently formed for short-term tasks in each of the history classes. One example already discussed in this chapter is the use of small groups to engage in historical simulations. Another is using a variety of peer cooperative learning strategies to process a difficult short reading assignment of several paragraphs from the text, a newspaper article, or a historical documentary shown during class. Students are more likely to engage in the material and have increased confidence to participate in class discussion through use of carefully assigned and monitored peer cooperative learning activities (Johnson, Johnson, & Smith, 1991). Students who are academically underprepared often battle deficits in content knowledge as well as self-confidence and self-esteem that erect powerful barriers to learning. It is important for class instructors to follow protocols carefully for implementing peer cooperative learning activities to create safe environments for students to work in small teams where they can feel comfortable to self-disclose what they know and do not know about the content. Success and confidence built in ungraded small-group activities can spur higher confidence and self-esteem.

For example, "Think-Pair-Share" is a common strategy used in the world history class. Students are assigned during class to read a short textbook selection of a historical source document (e.g., account of a woman's perspective of the French Revolution). This activity comprises the "Think" part of the process because students silently read the selection after viewing a question guiding their reading previously posted by the instructor on the blackboard. The next part of the process, "Pair," requires students to turn to fellow students next to them, jointly discuss what they just read, and then discuss the thought question posed by the instructor. The class often quickly becomes an energized collection of small group discussions in which nearly all class members participate. The instructor circulates around the room to monitor the discussion but generally does not participate other than to respond to questions or prompt the occasional group to move forward with the activity. The activity concludes with "Share" when the instructor calls the class back together once again and solicits volunteers to discuss what their small group discovered about the subject and to share a response to the thought question. Gradually throughout the academic term more students volunteer to discuss their ideas in front of the entire class. Students begin to engage more frequently with one another rather than always directing their responses to the instructor.

Summary and Recommendations for Further Investigation

The educational practices contained within this chapter can be used in whole or in part by classroom instructors, learning assistance personnel, or student paraprofessionals in a variety of ways. Instructors of history or other academic content courses could select activities from this chapter that are appropriate to the academic preparation level of the students and the academic expectations for the particular institution. Another variable that comes into play is the resources made available to the instructor by the campus. Is there a campus faculty development center, academic learning center, or developmental education department that the faculty member can consult and that can provide additional suggestions for embedding effective practices? Most of the recommended practices in this chapter do not require extensive preparation or formal coursework in developmental education, as helpful as those would be.

Another potential user of these recommendations is a person who teaches reading or study skills or perhaps administers a learning assistance center that employs peer tutors. A short unit of a history period or topic could provide the academic content material for practice and mastery of academic study strategies. Providing practice with real-world academic tasks is helpful for student paraprofessionals such as peer mentors or academic tutors. As previously noted, research suggests that students learn study strategies best when they make immediate application to real academic content material that they will encounter in their general education and degree completion courses. Using short textbook sections, guest lectures by college instructors, and historical documentaries can provide the real-world learning environment that enables students to learn more from their study skills classes, reading courses, learning strategy workshops, and peer tutoring sessions. These sorts of collaborative activities provide another opportunity for partnership among the academic community of advisors, counselors, faculty members, learning assistance personnel, staff, and others at the institution.

Embedding the best practices of developmental education within core curriculum subjects in General College has shown some elements of success over the past several decades. However, not all students who could benefit from the General College experience are successful. Although the activities and pedagogies described in this chapter have enabled many to succeed, the question remains concerning why some students opt out of availing themselves of these resources and opportunities. Additional research and investigation concerning deeper issues of student motivation are needed. Cognitive psychologists have begun these investigations, especially with elementary and secondary students. These studies need to be more fully extended to postsecondary education. Research partnerships among cognitive psychologists and content-area classroom instructors can illuminate the complicated nature of student motivation and guide institutions and all members of the learning community to adapt themselves to the needs of their students regarding the optimum learning environment. This represents the next wave of innovation that demands our immediate attention to meet the needs of our diverse student population and requirements for living in an increasingly complex and interrelated world.

References

Adams, D., & Hamm, M. (1990). *Cooperative learning: Critical thinking and collaboration across the curriculum*. Springfield, IL: Charles C. Thomas.

American College Testing Program. (2003a). *ACT institutional data file for 2003*. Iowa City, IA: Author. Retrieved July 1, 2004, from http://www.act.org/oeep/droptables.html

American College Testing Program. (2003b). *National collegiate dropout and retention rates*. Iowa City, IA: Author. Retrieved January 11, 2005, from http://www.act.org/path/postsec/droptables/pdf/2003.pdf3

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

Arendale, D. (1998). Increasing the efficiency and effectiveness of learning for first year students through Supplemental Instruction. In J. L. Higbee & P. L. Dwinell (Eds.), *Developmental education: Preparing successful college students* (pp. 185–197). Columbia, SC: The National Association for Developmental Education and the National Resource Center for the First-Year Experience and Students in Transition, University of South Carolina.

Astin, A. W. (1993). *What matters in college: Four critical years revisited.* San Francisco: Jossey-Bass.

Barefoot, B. O. (2003). *Findings from the Second National Survey of First-Year Academic Practices, 2002*. Brevard, NC: Policy Center for the First Year of College. Retrieved March 5, 2004, from http://www.brevard.edu/fyc/survey2002/ findings.htm

Bastedo, M. N., & Gumport, P. J. (2003). Access to what? Mission differentiation and academic stratification in U.S. public higher education. *Higher Education: The International Journal of Higher Education and Educational Planning, 46*, 341–359.

Bennett, R. B., Jr., Leibman, J. H., & Fetter, R. E. (1997). Using a jury simulation as a classroom exercise. *Journal of Legal Studies Education, 15*(2), 191–210.

Boekaertis, M., & Niemivirta, M. (2000). Self-regulated learning: Finding a balance between learning goals and ego-protective goals. In M. Boekaertis, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 417–450). San Diego, CA: Academic Press.

Bohr, L. (1994). Courses associated with freshman learning. *Journal of The Freshman Year Experience, 6*(1), 69–90.

Boylan, H. R., Saxon, D. P., & Boylan, H. M. (2002). *State policies on remediation at public colleges and universities.* Unpublished manuscript, National Center for Developmental Education, Appalachian State University, Boone, NC. Retrieved March 5, 2004, from http://www.ced.appstate.edu/centers/ncde/reserve%20reading/state%20Policies.htm

Bredemeier, M. E., & Greenblat, C. S. (1981). The educational effectiveness of simulation games: A synthesis of findings. *Simulation & Gaming: An International Journal, 12*, 307–332.

Bruffee, K. A. (1993). *Collaborative learning: Higher education, interdependence, and the authority of knowledge.* Baltimore, MD: The Johns Hopkins University Press.

Chaffee, J. (1992). Critical thinking skills: The cornerstone of developmental education. *Journal of Developmental Education, 15*(3), 2–4, 6, 8, 39.

Cooper, J., Prescott, S., Cook, L., Smith, L., & Mueck, L. (1990). *Cooperative learning and college instruction: Effective use of student learning teams.* Long Beach, CA: The California State University Foundation.

Cruthird, J. R. L. (1986). *Remedial/developmental instruction in an actual classroom situation: Interfacing social science, English, and writing.* Unpublished manuscript, Kennedy-King College, Chicago, IL. (ERIC Document Reproduction Service No. ED286978)

Dembo, M. H. (1994). *Applying educational psychology* (5th ed.). New York: Longman.

Doyle, T., & Kowalczyk, J. (1999). The Structured Learning Assistance Program model. In M. Hay & N. Ludman (Eds.), *Selected Conference Papers of the National Association for Developmental Education, Volume 5* (pp. 4–7). Warrensburg, MO: National Association for Developmental Education. Retrieved June 22, 2004, from http://www.umkc.edu/cad/nade/nadedocs/99conpap/tdcpap99.htm

Dreyfus, A. E. (Ed.). (2004). *Internet homepage of the Peer-Led Team Learning Program* [On-line]. Retrieved June 22, 2004, from http://www.pltl.org

Druckman, D. (1995). The educational effectiveness of interactive games. In D. Crookall & K. Arai (Eds.), *Simulation and gaming across discipline and culture* (pp. 178–187). London: Sage.

Francisco, J. S., Trautmann, M., & Nicoll, G. (1998). Integrating a study skills workshop and pre-examination to improve students' chemistry performance. *Journal of College Science Teaching, 60*, 273–278.

Gabelnick, F., MacGregor, J., Matthews, R. S., & Smith, B. L. (1990). *Learning communities: Creating connections among students, faculty, and disciplines.* San Francisco: Jossey-Bass.

Ghere, D. L. (2000). Teaching American history in a developmental education context. In J. L. Higbee & P. L. Dwinell (Eds.), *The many faces of developmental education* (pp. 39–46). Warrensburg, MO: National Association for Developmental Education.

Ghere, D. L. (2001). Constructivist perspectives and classroom simulations in developmental education. In D. B. Lundell & J. L. Higbee (Eds.), *Theo-*

retical perspectives for developmental education (pp. 101–108). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Ghere, D. L. (2003). Best practices with students in a college history course. In J. L. Higbee (Ed.), *Curriculum transformation and disability: Implementing universal design in higher education* (pp. 149–161). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Higbee, J. L. (Ed.). (2003). *Curriculum transformation and disability: Implementing universal design in higher education*. Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Higbee, J. L., & Dwinell, P. L. (1998). Thinking critically: The relationship between student development and the ability to think critically. *Research & Teaching in Developmental Education, 14*(2), 93–97.

Jehangir, R. R. (2002). Higher education for whom? The battle to include developmental education at the four-year university. In J. L. Higbee, D. B. Lundell, & I. M. Duranzyk (Eds.), *Developmental education: Policy and practice* (pp. 17–34). Auburn, CA: National Association for Developmental Education.

Johnson, D., Johnson, R., & Smith, K. (1991). *Active learning: Cooperation in the college classroom*. Edina, MN: Interaction Book.

Kerr, L. (1993). Content specific study strategies: A repertoire of approaches. *Journal of College Reading and Learning, 25*(1), 36–43.

Kipp, S. M., Price, D. D., & Wohlford, J. K. (2002). *Unequal opportunity: Disparities in college access among the 50 states*. Indianapolis, IN: Lumina Foundation for Education. Retrieved September 27, 2004, from http://www.luminafoundation.org

Light, R. J. (2001). *Making the most of college: Students speak their minds.* Cambridge, MA: Harvard University Press.

Luvaas-Briggs, L. (1984). Integrating basic skills with college content instruction. *Journal of Developmental Education, 7*(2), 6–9, 31.

Malnarich, G., with Others. (2003). *The pedagogy of possibilities: Developmental education, college-level studies, and learning communities*. National Learning Communities Project Monograph Series. Olympia, WA: The Evergreen State College, Washington Center for Improving the Quality of Undergraduate Education, in cooperation with the American Association for Higher Education.

Martin, D. C., Blanc, R., & Arendale, D. (1994). Mentoring in the classroom: Making the implicit explicit. *Teaching Excellence Newsletter, 6*(1), 1–2.

Martinez, S., Snider, L. A., & Day, E. (2003). *Remediation in higher education: A review of the literature.* Topeka, KS: Kansas State Board of Education.

Retrieved March 5, 2004, from http://www.ksde.org/pre/postsecondary_remediation.doc

Moore, R., Jensen, M., & Hatch, J. (2002). The retention of developmental education students at four-year and two-year institutions. *Research & Teaching in Developmental Education, 19*(1), 5–13.

Parsad, B., & Lewis, L. (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000, statistical analysis report*. Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved March 5, 2004, from http://nces.ed.gov/pubs2004/2004010.pdf

Paul, R., & Elder, L. (1999). Critical thinking: Teaching students to seek the logic of things. *Journal of Developmental Education, 23*(1), 34–35.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeldner (Eds.), *Handbook on self-regulation* (pp. 451–502). San Diego, CA: Academic Press.

Randell, J. M., Morris, B. A., Welzel, C. D., & Whitehall, B. V. (1992). The effectiveness of games for educational purposes: A review of recent research. *Simulation & Gaming: An International Journal, 23*, 261–276.

Renkl, A., Atkinson, R. K., & Maier, U. H. (2000). From studying examples to solving problems: Fading worked-out solution steps help learning. *Proceedings of the 22nd Annual Conference of the Cognitive Science Society*. Philadelphia, PA: Institute for Research in Cognitive Science. Retrieved January 14, 2004, from: http://www.ircs.upenn.edu/cogsci2000/PRCDNGS/SPRCDNGS/PAPERS/RENAT-MA.PDF

Shaw, K. M. (1997). Remedial education as ideological battleground: Emerging remedial education policies in the community college. *Educational Evaluation and Policy Analysis, 19*, 284–296.

Silver, D., Bourke, A., & Strehorn, K. C. (1998). Universal Instructional Design in higher education: An approach for inclusion. *Equity and Excellence in Education, 31*(2), 47–51.

Stahl, N. A., Simpson, M. L., & Hayes, C. G. (1992). Ten recommendations from research for teaching high-risk college students. *Journal of Developmental Education, 16*(1), 2–4, 6, 8, 10.

Stone, N. R. (1990). Ideas in practice: Developing critical thinkers: Content and process. *Journal of Developmental Education, 13*(3), 20–26.

Stratton, C. B. (1998). Transitions in developmental education: Interviews with Hunter Boylan and David Arendale. In J. L. Higbee & P. L. Dwinell (Eds.), *Developmental education: Preparing successful college students* (pp. 25–36). Columbia, SC: National Association for Developmental Education and the National Resource Center for the First-Year Experience and Students in Transition, University of South Carolina.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago: The University of Chicago Press.

Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student persistence. *Journal of Higher Education, 68*, 599–623.

Treisman, U. (1985). A study of mathematics performance of Black students at the University of California, Berkeley. *Dissertation Abstracts International, 47*(05), 1641A.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wilcox, K. J., delMas, R. C., Stewart, B., Johnson, A. B., & Ghere, D. (1997). The "package course" experience and developmental education. *Journal of Developmental Education, 20*(3), 18–20, 22, 24, 26.

Wilson, A. L. (1993). *The promise of situated cognition*. (New Directions for Adults and Continuing Education, No. 57). San Francisco: Jossey-Bass.

Yaffe, D. (1998, May 27–June 2). Ivy League remediation? Yes. *The Village Voice*, Issue 22. Retrieved March 5, 2004, from http://www.villagevoice.com/ink/news/22yaffe.shtml

CHAPTER 13

Aesthetic, Metaphoric, Creative, and Critical Thinking: The Arts in General College

Patricia A. James

ABSTRACT

This chapter describes ways that the arts have been used in General College. First, I outline contributions of the arts to education, including aesthetic, metaphoric, creative, and critical thinking and a deeper understanding of other people and cultures. Second, I sketch the history of the arts in General College and describe a few of the many ways that General College faculty have used the arts in arts-focused classes and other subjects. Next, I paint a portrait of one student's learning in a hands-on art course. Finally, I offer suggestions for teaching the arts in developmental education.

As you walk through Appleby Hall, the home of the General College (GC), you encounter five colorful murals designed and painted by students. The mural near the entrance of the ground floor features portraits of students painted by their classmates (see book jacket), and in the Writing Center there is a vibrant, puzzle-like mural about learning and creativity. A third mural features a "tree of learning," and the fourth mural, a landscape of the Mississippi River and downtown Minneapolis as seen from the art lab window, is framed by students' writings about the river. The newest mural, "Face to Face," is a visual symbol of students' sense of unity as a learning community. A first-floor display case promotes the "Horatio Project," an ongoing musical collaboration among students, staff, and faculty; two second-floor display cases often are filled with students' photomontages and expressive writing; and on the third floor there are exhibits of students' artwork about biological concepts.

In addition to the visual art in the halls, you might hear an insistent rap beat emanating from a basic writing class doing a critical study of hip-hop culture, the rhythmic sounds of anthropology students playing traditional indigenous instruments in a drum circle, or Teaching Specialist Jeff Chapman playing an Ojibway flute for his students (Opitz, 2004). If you go into some of the classrooms, you might observe basic writing students performing dramatic monologues of Sapphire's (1997) novel *Push* or students in the course Film and Society enthusiastically discussing Erroll Morris's (1988) documentary film, *The Thin Blue Line*. In the art lab, you might see students moving together in paper masks to explore metaphors of identity and anonymity, or students in General Arts watching a video about Pacific Rim dancers (*Dancing in One World*, 1993) to learn about relationships between art forms and cultural beliefs. Students' involvement in the arts does not stop at the doors of Appleby Hall, however. On campus, you might encounter a class of General Arts students discussing a work of public art, heading over to the Weisman Art Museum, which is less than two blocks from Appleby Hall, or going to a concert put on by the School of Music.

Each of the above examples illustrates ways that GC students learn about, through, and with the arts (Goldberg, 1997) in art content courses as well as in other subjects. Despite rich possibilities for learning, however, the arts are not often part of developmental education. This omission may be a consequence of beliefs that the arts have little relevance to the verbal and mathematical skills needed to succeed in higher education, that they are merely subjective expressions of personal emotions that cannot be evaluated, or that they require skills only a talented few can achieve. The arts, however, can be accessible at any level of ability and experience when they are taught in ways that help students make sense of them, and they offer alternative ways for students to develop knowledge and thinking processes needed in higher education. Artistic content and processes can be a valuable part of developmental education for all students, including those who have little previous interest or experience in the arts, who have actively participated in the arts, who learn best in nontraditional ways, or who plan to major in subjects such as graphic design, performing arts, or architecture.

The arts have been part of GC since the 1930s, and they continue to play an important role in courses dedicated to the arts as well as in other disciplines such as anthropology, basic writing, and biology. In this chapter, I discuss contributions of the arts to learning and various ways that artistic content and processes have been incorporated in the GC curriculum. To show learning from students' perspectives, I include samples of their writing and a case study of one student as she created art in a first-year learning community. Students' names have been changed to protect their anonymity. I use the term "art" to signify the aesthetic, metaphoric, and creative processes and products that symbolically express human experience throughout history and across all cultures. I take a broad approach that includes fine arts found in museums, galleries, and theaters; traditional arts from cultures around the world; and popular art forms such as movies, music, and commercial design.

The Arts and Learning

The Arts as a Bridge

Students in developmental education have to navigate and negotiate the traditions, discourse, and values of higher education, which may be very different from their home world of family, work place, and peers (Beach, Lundell, & Jung, 2002). The arts offer students ways to construct bridges between their personal and cultural knowledge and that of the academic world. Many students have been actively involved with the arts through high school experiences, church, private lessons, community groups, or self-instruction. Some of these students participate in artistic communities, such as a Hmong student who performs traditional dances at cultural gatherings, an African American student who sings with a gospel group, a Caucasian student who plays drums in a rock band, or a Native American woman who practices traditional dancing and beading. Other students engage in the arts as a form of personal expression, including the young woman who practices modern dance 40 hours per week or the football player who loves to draw. Victor, a Vietnamese American who writes and records his own rap songs, described what making art means to him:

> I open up my audio recording tools and breath tough as the instrumental I created starts up. Words jolt out of my mouth in a rhythmic tune and I must concentrate on lyrics and pronunciation. The chorus is up, and this is when I get a chance to do a little singing. I don't make songs for money or for fame, I just make them for myself. With the experience of producing and recording tracks since 1998, I've made about 20 tracks ranging from Rap and R & B, and they're only getting better!

Students who practice the arts in their own lives learn valuable skills such as collaborating with others, discerning patterns and nuances in what they see and hear, trusting their own judgment, and managing their time. These abilities can be a foundation for learning new concepts and skills in school (Ball & Heath, 1993). Victor sees his learning in music as an evolutionary process, and he has learned to critique his own work. Equally importantly, Victor has learned to place himself within larger artistic traditions and to care passionately about his music for its own sake, not for external rewards like grades. Victor's experiences making music give him confidence and skills that he can use in his academic courses.

Even if they do not actively create art themselves, most students are immersed in the images, sounds, and ideas of the popular arts, including music, television, movies, and computer games. Because it relates to students' own experiences, interests, and peer culture, popular culture is a valuable resource for teaching many kinds of concepts (Pedelty, 2001). For example, hip hop can provide a bridge between students' own knowledge and academic discourse. Professor Geoff Sirc, who uses hip hop culture as a springboard for teaching academic writing, suggested that "rap provides more of a common ground for my students than mainstream literary sources. Using it in the classroom lets students use their own language" (Weber, 2001, p. 7).

Multiple Paths to Learning

Researchers are finding that it is important that students develop a repertoire of ways to construct knowledge:

> The ways in which we conceive of learning and alternative ways of knowing are expanding our notions about what it means to be literate in today's society. A heightened awareness of multiple paths to learning and knowledge construction has begun to emerge. (Sweet, 1997, p. 272)

The polymodal nature of the arts offers students opportunities to build on their intellectual strengths and improve in weaker areas. By engaging in artistic processes or studying works of art, students experience new kinds of academic success and ways of being engaged in learning. The arts help students develop a multiliterate approach to learning. As Bleedorn (1998) put it, "the question becomes not so much 'how smart are you?' but 'how are YOU smart?'" (p. 19).

In a synthesis of research about creative people in all fields, Root-Bernstein and Root-Bernstein (1999) identified transdisciplinary "thinking tools" (p. 25) that shape the theories and practices of all disciplines, including observing, imagining, abstracting, analogizing, empathizing, transforming, and synthesizing. The authors suggested that college students must become adept with these thinking processes if they are to understand disciplinary concepts and construct new knowledge:

> Creative thinking—the kind of thinking in every discipline that generates and conceptualizes new insights—relies on what the philosopher Michael Polyani has called "personal knowledge": images, patterns, sensual and muscular feelings, play acting, empathizing, emotions, and intuitions. Those forms of knowledge have almost no place in our universities, where thinking is almost universally presented as if formal logic were its basis, and words and mathematics its languages of choice. New ideas, however, originate in nonlogical and nonverbal modes that are translated only later into symbolic languages. By slighting those preverbal forms of thinking, we stifle the inventive capacities of many students. . . . The most successful people in every field share an ability to think in ways that we seldom teach in the classroom. We owe it to our students, and to the world that can benefit from their creativity, to teach them how to recognize and use those mental tools. (Root-Bernstein & Root-Bernstein, 2000, p. A54)

The Root-Bernsteins (1999) believed that the arts are an important means for developing these thinking tools:

> To think is to feel and to feel is to think. . . . In some cases, sensing and feeling are most naturally communicated as visual, literary, or musical expressions. Indeed, the arts in a liberal arts education are important because they provide the *best* and in some cases the *only* exercise of many thinking tools, both in imagination and in expression. . . . The arts are not merely for self-expression or entertainment. (p. 317)

The open-ended, complex nature of the arts can help students become "self-authoring" people who understand themselves not as mere receivers of preauthorized knowledge, but as independent thinkers who are comfortable with the uncertainty of knowledge and capable of contributing to new knowledge (Baxter Magolda, 1992). For example, Mark, a freshman in the Creativity Art Lab, reflected about how the arts affected his thinking when he struggled to make two photomontages:

> The most profound insight [that] came to me while doing the photomontages involved the pictorial nature of the human mind. How we assimilate pictorial images and put them together to form some sort of a whole. [Making photomontages] asked me to ponder the idea of the universe being quarks all fitting together though some not as well as others. I really enjoyed working with this idea and have taken it outside the classroom. I think that this type of assignment may stimulate some part of the brain or internal process that helps us to see this is how we construct our reality.

Thinking in the Arts

The arts engage students in complex, open-ended interactions with media, ideas, cultural beliefs and values, symbolic systems, and personal knowledge. Four closely related processes are involved: aesthetic, metaphoric, creative, and critical thinking.

Aesthetic thinking. Parker Palmer (1999) suggested that the educational system of this country forces students "to live out of the top inch and a half of the human self; to live exclusively through cognitive rationality and the powers of the intellect; to live out of touch with anything that lays below that top inch and a half—body, intuition, feeling, emotion, relationship" (p. 17). The integrative nature of the arts helps students go beyond traditional dichotomies, such the separation of body and mind or feeling and thinking, to learn in more embodied, holistic ways that increase insight and retention of learning. Making art and experiencing the arts are aesthetic experiences that demand thoughtful, wholehearted, and embodied participation.

One quality of aesthetic thinking is paying close attention to sensory information. Although this seems like a natural process, aesthetic perception needs to be learned, especially in our fast-paced society in which experience is too often mediated by the highly produced images, sounds, and messages of popular culture. To practice aesthetic perception in the General Arts class, students find a place inside or outside the nearby Weisman Art Museum (2004) and take notes for 20 minutes on everything they see, hear, smell, or touch; they then use their notes to write a descriptive paper. Although this strange metal-clad building, which some have likened to a crushed tin can, often elicits dislike when students see it for the first time, writing about their perceptions helps them put aside premature judgments and be more open to learning about it. Students often describe the overlapping steel panels, reflections of the sky on the intersecting curved planes, the way air smells, shadows, and the sounds of traffic. This kind of perceptual experience engages students' minds, senses, and emotions—they will never again see the building in quite the same way. Aesthetic perception of the environment, objects, and other people can serve as a rich foundation for writing, reading, and discussion and as a catalyst for further study of historical, environmental, and sociological contexts.

Metaphoric thinking. Metaphors shape everyday discourse and our understanding of the world (Lakoff & Johnson, 1999). To understand and express abstract concepts, it is important that students know how to think metaphorically (James, 2000a, 2002; Pugh, Hicks, & Davis, 1997; Sanders & Sanders, 1984). Metaphoric thinking is an imaginative and empathic process that is at the heart of artistic expression, but it also shapes theories in other disciplines, including the sciences and social sciences (Root-Bernstein & Root-Bernstein, 1999). Metaphors enable students to make abstract ideas more immediate and engaging and to experience the way the world looks, sounds, and feels from other points of view. Students can use metaphors to express and understand ideas that cannot be articulated in any other way (Feinstein, 1996; Greene, 2001). By making metaphoric associations between seemingly dissimilar entities, students think about one thing, such as "community," in terms of another, such as "circles," and develop greater insight by connecting these concepts with their memories, senses, and emotions.

When students make or interpret art, they construct metaphors that express their emotions, experiences, and ways of seeing the world. As dancer and choreographer Twyla Tharp (2003) pointed out, "metaphor is the lifeblood of all art, if it is not art itself" (p. 64). In the arts, all parts of a work can have metaphoric significance, not only the overt subject matter. Students learn that *how* something is expressed is as important as *what* is expressed. In a painting of a woman, for example, thick jagged black lines that harshly outline her face and body convey very different metaphoric meanings than if she were drawn in blended pastels that softly delineate her contours. The same woman painted as a tiny figure framed by a large space will evoke different thoughts and emotions than a painting in which her face boldly fills the entire picture plane.

Creative thinking. With the continually evolving nature of knowledge and society, it is important that students learn to be creative thinkers who can push beyond familiar boundaries and envision new ways of thinking and acting (Bleedorn, 1998; Caine & Caine, 1997; Root-Bernstein & Root-Bernstein, 1999). By engaging in the arts, students develop dispositions and skills that promote creative thinking, such as being adventurous and open-minded about unfamiliar ideas and experiences, exploring complexity, ambiguity, and paradox, and working with multiple perspectives (Eisner, 1998). The arts are an especially valuable way to help students develop imagination:

> [Imagination] makes possible the creation of "as-if" perspectives, perspectives that can be opened metaphorically and, oftentimes, through the exercise of empathy. Without the release of imagination, human beings may be trapped in literalism, in a blind factuality. . . . It is imagination that discloses possibilities—personal and social as well as aesthetic. (Greene, 2001, p. 65)

We sometimes think of artistic creativity as free-flowing and spontaneous, but it is actually a complex, evolutionary process shaped by a sense of purpose as well as by chance (Gruber, 1989). Students who are engaged in creative processes learn how to navigate between order and chaos, abstraction and concreteness, and spontaneity and logic. They have to solve problems, work with mistakes, and choose materials and methods that support their ideas. When students are creating, they learn to use diverse ways of knowing, including their emotions, senses, personal knowledge, and established cultural concepts, traditions, and practices.

Although many students declare, "I'm not a creative person," creative strategies and dispositions can be taught and learned (Cropley, 1992). When students know how to use specific strategies, such as juxtaposition, analogizing, elaborating, and substitution (Roukes, 1982), and when they understand the nonlinear stages of creativity, including researching, incubating, refining, and evaluating, they are better able to develop meaningful ideas and to find the resources with which to actualize them. Creative thinking is transferable to other situations: "Learning to think creatively in one discipline . . . opens the door to understanding creative thinking in all disciplines. Educating this universal creative imagination is the key to producing lifelong learners capable of shaping the innovations of tomorrow" (Root-Bernstein & Root-Bernstein, 1999, p. viii).

Critical thinking. "Creative thinking can be critical even as critical thinking can be creative" (Bleedorn, 1998, p. 19). Making sense of art is an open-ended, exploratory process that uses diverse kinds of knowledge. Although images, music, and movement are pervasive in our culture, we cannot assume that students know how to really see and hear them and to construct meanings that go beyond obvious subject matter. Each work of art offers students a new world of ideas—a world that they have to take time to think about, both in its own aesthetic terms and in relation to other art, ideas, and experiences. One way for students to understand a work of art is to use a four-stage model of art criticism: description, formal analysis, interpretation, and evaluation (Cromer, 1990). In this model, students first perceive the obvious physical qualities of the work and the formal relationships. They use this information, along with personal beliefs and experiences and knowledge about larger social and cultural contexts, to construct meaningful interpretations and evaluations of the work.

The arts can serve as a focus for critical thinking about social and cultural issues. Contemporary art forms that explicitly comment on the norms and practices of society challenge students' beliefs and heighten their awareness of social inequities. In a cultural studies approach to the arts, students learn to think critically about the impact of the arts on people's lives and how society and culture inform artistic production, meaning, and worth (Freedman, 2003). Students also learn to distinguish different functions of art, including fine arts, the sacred and folk arts of traditional cultures, functional arts used in daily life, and popular media.

The arts as shared experience. What students bring to a work of art is as important as what they find in it. Experiences with art are "situated encounters," in which "the perceivers of a given work of art apprehend that work in the light of their backgrounds, biographies, and experiences. We have to presume a multiplicity of perspectives, a plurality of interpretations" (Greene, 2001, p. 175). When students study or make art together, they articulate and deepen their awareness of their own and others' experiences and worldviews. Students can understand diverse cultures in ways they might never have known if people had not translated their stories, traditions, values, and concerns into aesthetic forms. For example, *Wacipi-PowWow* (1995), a video about a national PowWow of the Mdewankanton Dakota Community, shows the particular colors, sounds, movements, and regalia of a culture that cannot be represented through any other means, and helps students understand ways that Native cultures have both adapted to and resisted dominant cultures.

The arts promote dialogue and collaboration among students. Students learn to understand culture not as a fixed body of knowledge, but as an open-ended, shared, negotiated process. When students make and study works of art together, they articulate their own points of view and hear multiple interpretations and different life perspectives. For example, when students create performances that express their own experiences, they teach their peers about diverse cultures from a student perspective, such as what it is like to be an immigrant in this country or how it feels to make choices between staying in the 'hood or going to college.

Although making art is often thought to be a solitary process, it is made richer through interactions with other people (Amabile, 1983; Hurwitz, 1993). Students develop collaborative skills such as piggybacking on each other's ideas and asking for and offering feedback and support. Making and thinking about art with others encourages self-understanding and promotes empathy with other people. Toya, a student in the Creativity Art Lab, wrote about how other students influenced her learning:

> Risk taking plays a big role in art. I think that is what made me finally realize that putting myself out there, and opening myself up to comments and criticism is what turned this class into an artistic learning experience. . . . I never knew some of my classmates thought in the ways that they did. I like that we get to see some of the thoughts that are going through their minds because others may be thinking the same thing.

Historical Role of the Arts in General College

The arts have been a part of GC since its inception. In 1934, the Carnegie Corporation of New York gave a 2-year, $10,000 grant to GC, with which Dr. Ray Faulkner and his staff developed a new arts curriculum and experimented with innovative teaching methods. They hoped to shift from the traditional academic model of arts appreciation courses, with an emphasis on works from the past, to an approach that would be more responsive to contemporary students' lives (General College, 1938). To achieve their goals, the college created a three-quarter long sequence of courses called General Arts Orientation to provide students with an overview of the arts that would be relevant to their lives.

The main objective of the General Arts sequence was to promote understanding and enjoyment of the arts as "expressions of vital, human living" (Hill, 1940, p. 204) that influence our everyday lives and environments. The staff created an ambitious curriculum that included painting, sculpture, architecture, music, literature, theater, movies, photography, crafts, and commercial art. The first course in the General Arts sequence focused on the arts as an expression of universal human needs, the second course explored problems of formal organization in the arts and factors that contribute to good design, and the third course studied materials and techniques in various art forms. Students who completed this sequence could go on to take specialized courses such as Art Laboratory, Music Laboratory, and Film and Drama.

These traditions continued through the 1960s and 1970s, when a number of professional artists and musicians taught on the GC faculty. Among them were Louis Safer, a visual artist whose portrait of John Berryman is owned by the National Gallery in Washington, DC (T. Brothen, personal communication, September 24, 2004); Richard Byrne, who conducted the choir at the St. Paul Cathedral; and Jerry Gates, who made and exhibited paintings, jewelry, and later, computer graphics (General College, 1968; Weber, 2001). An increased emphasis on career development after World War II fostered a number of commercial arts courses that trained students in graphic design.

In the 1970s the GC's Humanities in Modern Living two-course sequence was taught by a rotating team of professors who organized the courses around themes related to students' lives, including community, mental health, and friendship. One of the themes that Professor Robert Yahnke worked with was "aging," in which he combined poetry, film, and readers' theater to help students construct a deeper understanding of concepts and experiences related to aging. Although this course ended after several years, the idea of working thematically was continued in several interdisciplinary "package courses" that integrated the arts and humanities with the sciences and social sciences, one of which was called "Toward the Good Life." Three courses were combined into one for a total of nine credits. The professors contributed their disciplinary knowledge to the exploration of themes such as family and leisure. The openness of the collaboration allowed for students and professors to use multiple approaches to explore some of the "big questions" in life (R. Yahnke, personal communication, March, 2004).

Another interesting package course involved a collaboration between art and mathematics. Professor Doug Robertson and art instructor Carol Nelson designed two linked courses to explore relationships between mathematics and the visual arts. Students learned mathematical concepts such as measurement, graphing, scaling, plane and solid geometry, and patterns, and then they drew, constructed models, and painted works of art based on these principles. The goal was for students to find greater real-world relevance in mathematics, to learn to solve mathematical problems, and to practice problem-solving tools in the arts. For their final project, students completed a work of art that expressed a mathematical concept (Robertson & Nelson, 1976).

Contemporary Role of the Arts in General College

The first issue of *Access*, the GC magazine, highlighted the college's ongoing commitment to the arts. General College Dean David Taylor (2001) suggested:

> Recent research has demonstrated the relationship between the arts and intellectual growth in other areas of development. For example, it is possible to teach the practical application of mathematics to music and the application of the visual arts to speech and language. The visual and performing arts have long been a part of the General College curriculum. We have always appreciated the connectivity between the arts and learning. (p. 2)

The following section is a sample of ways that students have learned about, through, and with the arts (Goldberg, 1997) in recent years. This is not a comprehensive survey of such courses, however; there are many more ways that GC instructors use the arts in their courses.

Learning About the Arts

Many students have little knowledge of the artistic traditions of their own or other cultures, whether it is Hmong needlework, Cubist paintings, the arts of the Harlem Renaissance, classical Greek sculpture, or American Indian powwows. Studying diverse forms of art helps undergraduates become "informed learners" who have a "deeper understanding of the world [they] inherit, as human beings and as contributing citizens" (Association of American Colleges and Universities, 2002, pp. 16–17). Two courses in General College teach the forms, methods, and traditions of the arts.

The Movies. Professor Robert Yahnke's film class introduces students to films that relate in some ways to their lives, but which also expand their knowledge of film, including Martin Scorsese's (1976) *Taxi Driver* and the Italian film, *Cinema Paridiso* (Tornatore, 1989). Students learn to do a close analysis of formal qualities, such as shots and angles, lighting, movement, editing, and sound. They also learn to read film as a form of literature with themes, character and plot development, dialogue, and conflict. By seeing repeated viewings of films, both in their entirety and in small segments, doing writing assignments, and engaging in class discussions, students develop a film vocabulary and learn to identify the aesthetic choices of various directors, which helps them dig deeper into the ideas and values in the film. Students learn to understand film as a medium for expressing and understanding complex personal and social issues.

General Arts. In this course, students study ways that various cultures use the arts to express ideas. Through prints, slides, readings, museum visits, music CDs, and videos, students learn how to think about a wide range of art forms, so that when they encounter works of art in their own lives, they will know how to begin to answer questions such as: How do materials and techniques affect the meaning of the arts? How are the formal aspects of art works organized? How do the arts reflect and shape culture? How do our own expectations, values, and experiences affect our interpretation and evaluation of art? How do the arts contribute to a meaningful life?

To prepare to write critical papers about works of art in local museums, students participate in activities that offer developmental practice in perceiving, analyzing, interpreting, and evaluating art. Students visit the Weisman Art Museum to write about works of art of their choice. The goal is to write as if they are teaching someone else how to look at and think about the work. In one paper, students write a complete description of what they perceive, including materials, size, subject matter, and setting. This is harder than it sounds, for students have to translate sensory information into words through which others can "see" the work. In another paper, they write a formal analysis about how the work is composed, including color and shape relationships, focal point, repetition, and balance. Doing a sketch of the work helps students recognize the underlying structure of the work. They also write a paper in which they do a personal interpretation of a work of art.

Students then go to the Minneapolis Institute of the Arts to write a longer paper about a work of 20th or 21st century art. This time, their interpretation includes contextual information, such as how society influenced the work. Many students have never been to a large art museum, so the paper assignment gives them an opportunity to see that museums are both accessible and enjoyable. They are thrilled to see such a wide range of arts from many cultures and historical periods in one building and to see work by artists that they have been reading about in their text (Yenawine, 1991), including Picasso, Matisse, and Warhol.

The objects and images found in museums, however, represent only a small part of artistic expression. Works of public art on local campuses and neighborhoods are accessible examples of art in our own communities. Teaching Specialist Jeff Chapman introduces General Arts students to public art in a number of ways, including a video titled *Public Sculpture: America's Legacy* (1994), a tour of public art on campus, and slides of local public art. Using everyday materials, students make connections between art and their own lives by creating models of imaginary works of public art and presenting them to the class.

Art is an integral part of students' daily lives, whether it is in the form of artifacts handed down from generation to generation or contemporary objects and clothing. To better understand the arts from a multicultural perspective, students see videos about artists from diverse cultures, including an American Indian potter (*Daughters of the Anasazi*, 1990), *Islamic Art* (1988), and modern Nigerian art (*Kindred Spirits*, 1991). These videos help students understand that art is an integration of cultural beliefs and values, symbol systems, and form and materials. Toward the end of the semester, students do poster presentations about a work of art in their own lives. Some of their choices have included a Somalian water jug, a Vietnamese song, a blown-glass vase from Hungary, an American wedding ring, Japanese cartoon books, and contemporary tattoos. Students' posters present information about form and technique, a brief history of the art form, relevance of the work to the culture in which it was made, and relevance of the work to the student. By seeing each other's posters, students learn about a wide range of art forms and deepen their awareness of the cultural diversity of their peers.

Learning With the Arts

Another way that the arts are used in GC is in courses such as basic writing, literature, anthropology, and biology. The arts offer content, symbol systems, and ways of knowing that can enrich other subjects and help students construct a deeper understanding of concepts. Theorists suggest that there is an interactive "dual coding" process through which people use images and other sensory information to think about words and words to think about images and other senses (Paivio & Walsh, 1993). By integrating visual or musical arts with writing, for example, students shape meanings that are richer and different from each of the modes of communication by themselves. Students also develop a greater awareness of aesthetic qualities in the world around them and build a sensory memory bank that can inform their reading and writing.

Composition. Many students share a love of rap music and hip hop culture. In GC 1422: Basic Writing, Professor Geoff Sirc draws on the powerful emotional, social, and physical impact of rap to help students construct bridges between their familiar worlds and the unfamiliar discourse of academic writing and research. Students in his course critically examine various texts about hip hop culture, including Internet sites, videos about dance and graffiti, and scholarly texts such as *Black Noise: Rap Music and Black Culture in Contemporary America* (Rose, 1994). They then write a research paper about an aspect of the hip hop culture that interests them. Sirc reported, "It becomes very compelling for students to examine something they know about. They see they have a knowledge pool to draw on, which allows for a transition from natural writing to scholarly writing" (Weber, 2001, p. 7).

Literature. Different forms of art have different kinds of meanings that enrich one another and contribute to a deeper understanding of a subject (Eisner, 2002). There are a number of ways that Teaching Specialist Barbara Hodne uses visual and musical art forms in her literature courses. For example, students see early 20th century Cubist paintings and listen to Stravinsky's

Rites of Spring symphony to grasp Modernist literary traditions. To help students better understand the creative impetus for poetry and how it drives people their own age to create poems, Hodne invites spoken word artists to perform in her class, including Frank Sentwali (*Edupoetic Enterbrainment,* n.d.). Students were touched by Sentwali's passion for using art to create social change, and his performance enabled students to make connections between a familiar rap format and more unfamiliar forms of poetry. Hearing live and recorded spoken word performances helps students learn to listen to poetry and to understand poetry as a vital form of communication. A student in Hodne's class told her that after hearing live spoken word, he now reads poetry differently.

Hodne uses visual arts to augment the readings in her American literature course. The photos both illustrate and contradict perspectives taken by the authors in the stories. For example, Jacob Riis's photos of workers in the Lower East Side (Alland, 1974) challenge the American ideal that hard work equals success, and photos of Americans from the 1930s (*Modern American Poetry*, 2002) are a contrast to Meridel LeSueur's (2002) autobiography, "Women on the Breadlines." Visual art also helps Hodne's students connect the readings to their own lives. When they read literature from the 1950s, students look at assemblages by Pop artist Robert Rauschenberg and answer the question: "How would *you* depict *your* times?"

Anthropology. Associate Professor Mark Pedelty uses music and performance to help students develop an awareness of their ethnocentric assumptions about other people and an understanding of other cultures from an insider's perspective. Students dramatically perform Mexican plays and poetry and write and perform fictional dialogues based on ethnographic readings. Pedelty noted that role playing discourages stereotypes and promotes empathy and identification with people from other cultures. In addition, students' learning is enhanced by using multiple senses (Weber, 2001, p. 9).

Pedelty's students enact rituals associated with myths, such as the Templor Mayor ritual once practiced by the Mexica as part of the Coyolxauhqui myth. Students use cross-cultural comparison to gain a critical understanding of their own cultural lives. Through these enactments, students learn the historical context of the ritual and begin to understand both ancient and contemporary use of ritual as a conduit between people and their gods. Using real and improvised instruments, small sections of students create percussive rhythms that underscore Pedelty's oration of the myth and ritual. In the process of doing this performance, abstract and esoteric knowledge becomes much more immediate and engaging to students, and they are better able to understand underlying anthropological concepts (Pedelty, 2004c).

Celebrating Diversity in Twentieth Century America Through Fiction and Film. In Professor Jeanne Higbee's freshman seminar, students read short stories and view films that explore cultural diversity. Higbee uses movies as a catalyst for a deeper understanding of cultural issues and experiences. For example, to help students better understand immigration and race issues, Higbee shows *Snow Falling on Cedars* (Hicks, 2000), a movie in which a Japanese-American man is falsely accused of killing a White man. Seeing and hearing the historical settings, clothing, facial expressions, tones of voice, atmosphere, sounds, and music helps students empathize with the characters and imagine themselves in the situation. At the end of the semester, students do expressive projects to demonstrate their learning in the course. In one such project, Hmong students adapted lyrics of "America" from *West Side Story* to create and perform a song titled "Because I'm Hmong."

Psychology of Personal Development. The primary focus of Jeanne Higbee's psychology course are the theories, vocabulary, and research methods related to individual growth and development. Students are tested on these topics through quizzes, essays, and exams, but Higbee also uses films, such as *The Breakfast Club* (Hughes, 1985), to help students learn psychological concepts and demonstrate their learning in alternative ways. At the end of the semester, students do an expressive project in which they work individually or in small groups to present course content. Some students have written poetry, created collages, skits, or videos about a theme they read about in their text. For example, one student created a half-hour video based on a TV talk show, including a live band and interviews with guests about various psychology topics, and another student created a comic book to illustrate psychological concepts.

Law and Society. At the end of the semester, students in Assistant Professor Karen Miksch's class, acting as lawyers, defendants, and judges, engage in a mock trial. To prepare for the trial, students do reading and writing assignments, but they also read Sophocles' classical play, *Antigone* (442 B.C.E.) and see part of an updated film interpretation of the play (Taylor, 1986). To help students understand and apply the concepts of natural law and positive law that underlie the play, Miksch asks: "How do the characters know the right way to act, and what do they look to for that information?" In small groups, students write scripts that update a scene from the play and perform it for the class. A number of groups creatively adapt the concepts to the current social scene; an imaginary conversation between Hillary Rodham Clinton and Bill Clinton, a Jerry Springer television show, action movies, and rap songs have served as taking-off points for thinking about the concepts of natural and positive law.

Multicultural Mathematics. In this Freshman Seminar, Assistant Professor Susan Staats uses visual arts from diverse cultures as a way for students to understand mathematical concepts and learn about ways that various cultures think mathematically. Students study textiles and crafts of other cultures to see how their patterns translate into mathematical terms and to learn about the cultural significance of shapes and colors in the designs. For example, students see ideals of beauty in Ghanian textiles, in which circles symbolize feminism, zigzags symbolize judicial authority, and blue connotes infinity (Antubam, 1963). Part of the course is based on *African Fractals, Modern Computing and Indigenous Design* (Eglash, 2002) and *Culturally Situated Design Tools* (Eglash, 2003), a Web site that shows how various cultures' designs can be thought about in terms of mathematical principles such as transformational geometry and Cartesian coordinates. Using computer simulations and graph paper, students create their own designs based on the principles.

Biology. Perhaps the sciences are the last subject in which we might expect to find the arts. Associate Professor Murray Jensen, however, has developed an assignment in which students represent biological concepts in nontraditional ways. In his "Do Something Cool" assignment toward the end of the semester, students in the human anatomy and physiology course show their learning by creating drawings, paintings, photographs, sculptures, or even live performances about topics such as muscle physiology, the consequences of crack cocaine on a human body, or the anatomy of a hand (Jensen, Moore, Hatch, & Hsu, 2003). Learning takes place not only when students plan and create these projects, but also when they present them to their class so that other students have the opportunity to think about biological concepts in new ways. Many of the projects are displayed on a course-related Web page (Jensen, 2004) as examples for future classes.

This arts-based biology assignment provides a "hook" that helps increase student retention in a science course that traditionally experiences attrition, especially among students who have difficulty learning through lectures, labs, and exams. Making visual representations of science concepts stimulates students' imaginations and gives them practice "thinking outside the box" when they are learning science. The "Do Something Cool" assignment also helps students understand that creative thinking is an important part of the sciences (Jensen et al., 2003).

Learning Through the Arts

Several courses in GC give students practice in actively creating art. Although students usually do not have sufficient expertise to work on a professional level, they are able to experience the kinds of thinking engaged in by accomplished artists and to create works of art that express their own worldviews and life experiences.

Film and Society. In Robert Yahnke's documentary class, students study a variety of documentary films and make videos about social issues that are relevant to them. To gain a visual and conceptual understanding of the documentary genre, students first study works by masters such as Werner Herzog, Errol Morris, and the Maysles brothers. Working in collaborative teams that include a director, videographer, and editor, students write a proposal that explains the rationale and methods of their potential work to an imaginary granting agency. After Yahnke approves the proposals, students take digital video cameras out to film in relevant locations. The real work, however, begins as students edit their raw footage into a coherent, 10-minute documentary. The digital editing process is like a puzzle; students know the general theme, but it is only when they struggle to connect the parts and add music that they are able to understand the relationships and meaning of their images. Recent student documentaries have included work about a local bike group, Karaoke in local bars, and a comic book artist.

Identity, Community, and Culture: Connections in the Arts and Humanities. In this interdisciplinary course, Mark Pedelty uses visual arts, dance, storytelling, and music to explore the political dimensions of the arts and ways that "the identities, ideologies, interests, and affiliations of those who create, support, or experience art inevitably influence artistic meanings" (Pedelty, 2004a, p. 1). To help students understand concepts in multiple ways and to provide practice with various song writing and performance processes, activities in every class session shift among a variety of media, including drum circles, films, discussions and peer reviews, socially-conscious music, poetry, and story-telling. In the "Horatio Project," which is based on Shakespeare's *Hamlet* (Edwards, 1985), students read the play and see scenes from various traditional and contemporized film versions of Hamlet (for example, Almereyda, 2000; Branagh, 1996) as they write, tell, or illustrate their own poems, songs, and stories of social injustice and corruption. Students record their work on a CD.

Music and Social Movements. This freshman seminar, taught by Mark Pedelty, uses music to focus on issues related to public education. Daily drum circles help students develop a sense of rhythm, deep listening skills, and responsiveness to music, and they provide opportunities for students to learn to collaborate and to try out their individual and ensemble musical projects. In addition to reading about and discuss opposing views on educational policy issues, students read a biography by or about a socially-engaged musician and give a presentation to the class about it. Students also write an autobiography about their own musical education and write music and song lyrics about education. There are several approaches: students compose their own music for their lyrics, write lyrics to music composed by Pedelty, and write lyrics for which Pedelty composes the music. A finished CD of the music and lyrics has been produced and sold to the local community to support projects related to public education (Pedelty, 2004b).

Creativity Art Lab: Experiments in the Media. In this course, students practice a variety of art forms. The approach of the course changes from semester to semester. One of the focuses is mural making, in which as many as 26 students collaborate with each other to design and produce a mural. Other semesters, the course focuses on multimedia performance, which I describe in the following section.

Art in Practice

When I teach the Creativity Art Lab, I emphasize creative and metaphoric process more than specific artistic techniques and finished products. Students learn to generate ideas and invent ways to translate them through ordinary materials, including their own bodies. The assignments are relatively open-ended problems with no set answers; although I establish some material, size, and thematic constraints, students develop content and methods that are meaningful to their own experiences and interests. Caine and Caine (1997) suggested that ill-formed, open-ended problems are a necessary part of meaningful learning: "Much more learning takes place when learners are constantly immersed in complex experience; when they process, analyze, and examine this experience for meaning and understanding; and when they constantly relate what they have learned to their own central purposes" (p. 19).

The design of the course is based on my belief that every student has artistic and creative potential. The unusual nature of the activities gives both artistically inexperienced and experienced students opportunities to think and act in new ways. We start with a photomontage assignment and shift to a focus on multimedia performance, including movement, spoken word, and music. Throughout the semester, students engage in reflective and expressive writing, hands-on activities, and discussion. Students contextualize their work within larger artistic traditions by seeing videos, slides, and a live performance. Small group and all-class exercises help students learn to trust and support one another and to feel confident taking creative risks.

To better understand how students learn aesthetic, metaphoric, creative, and critical thinking in the Creativity Art Lab, we can focus on one student, Risa. Risa was originally from South Asia, but she attended an American high school where she took a few art courses. Identifying herself as "somewhat" of an artist, Risa wrote that she was taking Art Lab "because I enjoy arts and it's something that gets better to my heart than my brain." She planned to major in retail merchandising when she transferred from General College.

Risa was part of a culturally-diverse cohort of 18 lower income, first-semester, first-generation, predominantly non-White TRIO students enrolled in a learning community of three linked courses. The goal of the learning community was to help students build social, cultural, and cognitive bridges between their nonacademic lives and higher education. We presented both academic and experiential ways for students to think about and express their personal and cultural identities, to practice actively being part of a community, and to become agents of their own learning instead of passive consumers. Multicultural Relations, taught by Counselor Advocate Rashné Jehangir, was a seminar in which students examined issues of class, race, gender, disability, and sexual orientation. Students read and discussed two texts: *Race, Class, and Gender in the United States: An Integrated Study* (Rothenberg, 1995) and *A Different Mirror: A History of Multi-cultural America* (Takaki, 1993). In the Writing Lab, taught by Assistant Professor Pat Bruch, students worked together to strengthen their ability to use writing to express ideas. Content from these courses served as resources for students' art work in Creativity Art Lab.

Learning Metaphoric Thinking: Getting the Inner Us Outside of Ourselves
As an introduction to metaphoric thinking, students' first assignment in the Art Lab is to write personal analogies (Gordon, 1973) about works of art. Students each choose a portrait from a collection of prints and free-write about it as if they are inside the work—first, as the person in the image, and then, as a smaller part of the image, such as an eye, hand, chair, or the sky (James, 2000a, 2002). Students begin each paragraph by writing "I am. . . ." After they finish writing, they read their paragraphs to a partner. Risa reflected about what it was like to do "I am" writing and share it with another person:

> Analyzing [the print] was like getting the inner us outside of ourselves . . . . I think it wasn't just analyzing a piece of art. Rather analyzing ourselves. I guess the way we view art could be a result of way how we view ourselves, I don't know. I felt connected to this activity. Also, hearing what someone else had for their art was interesting. My partner wanted to be air, which would mean she treasures freedom. Indeed, she did say that she fears her freedom is being taken away.

The "I am" writing requires students to spend extended time looking at the subtleties of one work of art and making metaphoric connections between the image and their own emotions and experiences. By taking an "as-if" perspective, students are encouraged to imagine and empathize with things outside of themselves and to reflect about their own thinking. Over the semester, students do "I am" writing about objects, music, dance, and their own photomontages.

Photomontages: Thinking "From Bottom to Top and West to East"

In the first major assignment of the semester, students cut and reassemble pictures from magazines and calendars to create two portrait photomontages. One photomontage has to feature a head or body, and another focuses on hands. I ask students to use substitution, juxtaposition, scale changes, and alteration to transform familiar images into abstract, visually unified, metaphoric works of art (James, 2000b). In addition to seeing slides of photomontages by established artists, students do several developmental exercises to practice creative thinking, develop visual perception, and gain a sense of themselves as creative people.

Hand exercises. In one set of exercises, we focus on multiple ways to think about hands. First, students do blind contour drawings by sketching one of their hands without looking down at their paper (Edwards, 1989). When students walk around the room to look at the jagged, disconnected lines of their peers' drawings, they learn that the process of *looking carefully* is important, not only the artistic product. Many students comment that when they draw in this way, it is as if they see their hand for the first time.

Next, students get into small groups and study one group member's hand. Students learn to pay close attention to sensory information by describing everything that they perceive in this person's hand, including wrinkles, scars, roughness, and color, as well as weight, thickness, smell, and even taste. In the next stage, the group interviews the group member about his or her hand: "What does the hand tell you about the person attached to it?" As students talk, a history of the hand emerges and students learn about the person's life. Each group then introduces "the hand" to the rest of the class. Students enjoy hearing stories about their classmates' hands, such as how they got their scars and what kind of work they do, and they begin to recognize relationships between form and content.

Finally, students write a list of movements they do with hands in their daily lives, such as eating or playing a musical instrument. Much to their surprise, I ask them to stand up and mime that movement in slow motion. After students practice for a while, they put on paper masks and, in small groups, repeat their movements for two minutes while the rest of the class observes. Students see that ordinary movements like putting on a shoe, eating, or brushing teeth become small, elegant dances when repeated in slow motion by a person wearing a mask. Risa reflected about what she learned by doing this series of hand exercises:

> I never thought about how much hands had to offer to our lives. How many memories it has, how unique our hands are—the palm, the lines, the knuckles, the nails, the fingers and everything else seemed unique and artistic. If just a hand was full of so many things, I couldn't imagine analyzing every other part

of our bodies. I am sure that the human body in itself is an art if you think about it. If you think as an artist there is art everywhere within us, like even in our hands.

Making photomontages. Before starting their two graded photomontages, students create an ungraded practice photomontage. They have about 40 minutes to cut out pictures and reassemble them into an image of a head. We hang the practice photomontages on the wall and discuss them in terms of visual composition, interpretation, and creative processes. By doing practice photomontages and seeing slides of successful student photomontages from previous semesters, students realize that that this assignment asks them to think in new ways. Although students often think that making a photomontage will be an easy assignment, they discover it can be an uncertain and often frustrating process.

Students spend several days in and outside of class working on their graded photomontages. They usually find that the appearance and meaning of their finished photomontages are very different from what they first planned. Some students start with a specific idea in mind, and they become frustrated when they cannot find the perfect picture for it. Others cut out random pictures but do not know how to put them together into something new. I encourage students to turn magazine pictures upside-down to see them in new ways. To make successful photomontages, students have to learn to choose images for their aesthetic qualities and metaphoric meanings, not only the literal subject matter.

When Risa started cutting random pictures from magazines, she did not know what she was going to do for her first photomontage, but she developed a sense of purpose as she worked. Her imagery started to make sense to her when she placed a column of flowers on each side of the paper. A sensuous arm reaches from the column on the right side across a central space of dark shapes and jagged edges to touch the other column, and the central area indicates ambiguity and tension between the two columns. Risa's finished photomontage (Figure 1) can be interpreted as an expression of the conflicts and pleasures of making a transition from childhood into adulthood. As part of the assignment, Risa wrote an "I am" paragraph interpreting her photomontage:

I am coming out of innocence
Entering through life,
Passing by the mysteries,
Full of certainty,
Carrying along hope,
Hiding the secret fear,
I hope to make it through,

> I hope to break it through,
> Until I reach peace and love for eternity.

Risa knew that she wanted her second photomontage to be a visual statement about how adults force little girls to grow up too quickly, and she started by cutting out a little girl's head and gluing it on a sexy adult female body. Risa wrote about her artistic intentions:

> [The] photomontage of a baby face with a slim female body juxtaposed together looked like something I had wanted. Why, I didn't know at that time. It made sense to me because I felt that little kids have to grow up too quick these days. Whether it's in the case of Jon Bonnet Ramsey or many other little beauty pageant girls or even in my case. Children are expected to act as adults when they should enjoy their young days having fun, as your age is something that will never come back.

Risa went through various stages of problem-solving and discovery. When I observed how her work was progressing, I noticed that the many pictures of small dolls scattered in the background distracted from her central figure. Risa was at a frustrating impasse and did not know how to proceed. When I asked her to tell me what part of the image she cared about the most, she replied that she liked the central figure. I encouraged her to emphasize that area and to downplay other parts. Without further help, Risa made a number of artistic decisions and threw away many of the pictures she had already spent time cutting out. She wrote:

> I was thinking about having dolls around my face and body photomontage to show that she was an innocent little girl. But then I found that was a mistake because it would have distracted viewers' attention from her to the dolls around her. I let her be all by herself.

Risa constructed a completely new background from articles on child psychology:

> I picked up a few magazines to find articles because I am going to have a text background. As other backgrounds may hold back the focus of the girl. So the text would support my message indirectly as well as it'll stick out, making the girl a focal point.

Risa's finished photomontage was visually unified and meaningful (Figure 2). Risa framed the child's head with long hair, eliminated extraneous objects, and replaced them with relevant fragments of printed articles and images of childhood, including a headline, placed sideways, which read: "Our Forebears Made Childhood Unbearable." The unobtrusive text added historical dimensions to her central image and created a visual texture that complemented the

Figure 1. Risa's first photomontage.

main figure. Risa's "I am" writing about the photomontage revealed some of the paradoxes of being female:

I am a girl
Pure and innocent,
I am a girl
Bold and beautiful,
I am a girl
Praised and pressured,
I am a girl,
Free and controlled,
I am a girl
Trying to fake it,
I am a girl
Trying to make it,
I am a girl
Dying and surviving,
I am a girl
Being judged and witnessed,
I am a girl, simply live my life as a girl.

Students' finished photomontages can serve as visual texts that offer insights into their own lives. Although Risa originally intended to create a social statement about other people, her reflective paper at the end of the semester revealed that her photomontage could also be interpreted as an expression of her own experiences as a teenager going to school in the United States while her parents remained in her native country:

> I am trying to stand on my own feet without any help from my parents as they are out of this country. I am taking care of my food, shelter, clothing, school, job, everything by myself. From paying bills to cleaning my apartment. It is all on me. When I should just be having fun and not worry about these things except school like most of my friends. I don't regret my duties. I find myself a lot more mature and confident. But, sometimes I feel exhausted as I am a teenager and am living a life like a middle-aged woman. In a way I am still young with my brain but a grown up with my actions, like my photomontage. Which I didn't realize before making it. When I was making my photomontage it never occurred to me that my thinking process would create something like that.

As she made her photomontages, Risa went through many of the same thinking processes that are engaged in by experienced artists, including generating ideas, making visual decisions, solving problems, and interpreting her work as it evolved (John-Steiner, 1997). Each of Risa's decisions caused her

Figure 2. Risa's second photomontage.

photomontages to evolve in ways she could not have predicted when she began making them:

> [What was] pleasurable was the surprise that came out of my piece. It was totally different than what I had on my mind when I started it. So many pieces weren't even used. What surprised me is you can do so much with pieces of magazines. Art is a combination of so many tiny pieces. It's really fun, it makes you think in an unusual manner. From bottom to top and west to east, just awkwardly. It is surely fun but not easy. You really have to think!

Performance: Showing, Not Telling

During the second half of the semester, students in Creativity Art Lab practice creative and metaphoric thinking by creating live performances that express social issues through images, movement, music, and spoken word. At the end of the semester, students create their own small group performances that they present to the rest of the class. Several videos of performing artists, including an African American women's dance troupe called Urban Bushwomen (1996), give students a deeper understanding of the expressive purposes and strategies of performing artists. We also attend a professional theatrical performance.

Although some students have prior experience performing, most are apprehensive about speaking or moving in front of others. To gain confidence in their own abilities and to feel comfortable with their peers, students engage in a number of creativity exercises in which they learn to generate ideas, improvise, and critique their own work and others' work. At first, students feel silly and there is a lot of giggling, but with repeated practice, they start to take the exercises more seriously. When everyone does the same exercises, they learn to support each other and to value their peers' ideas. Risa wrote about the important role other people played in her creative process: "I didn't know what to do, what inspired me was that most people in the classroom weren't experts either but they kept on going so I kept on trying many weird things."

Paper masks. In one creativity exercise, students make and wear paper masks based on a pattern from *Mask Improvisation* (Eldredge, 1996). The whole class uses the same color paper—usually green or blue—to emphasize sameness. In an exercise loosely based on an activity titled "Exposure" (Spolin, 1994), half the class, the masked "actors," stand in a row for 3 minutes while the other half, the "audience," sit and observe them. It is both a comical and an uncomfortable experience; many students never realized that 3 minutes could be so long! Afterwards, a discussion about what it is like to stand in front of or watch people with masks on helps students interpret masks as visual metaphors for concepts such as anonymity, individuality, and conformity. Some students report that when they wear the mask, they feel like prisoners, but others say they feel they have more control. Students often say that wearing the mask makes them think about what it feels like to be completely anonymous, but as others talk they become more aware of the individuality of movements and postures. Risa reflected:

> I liked today's activity because it was different than what I have done in the past. It was weird how having a mask on made everything so confusing. Besides the fact that I felt strange breathing with it and not being able to itch anywhere on my face. I felt as if it was blocking my thoughts too. The mask made me feel isolated somehow. I felt distance to the world. While I was standing in front of the room I felt as if I was being judged. I felt as if I had done something wrong and people watching me will soon declare their verdict.

Spoken word. The next series of creativity exercises culminates in individual spoken word performances. To become more comfortable speaking in class and interpreting poetry, students do several group spoken word exercises, including a whole-class reading of Maya Angelou's "Alone" (Angelou, 1994). We sit in a circle, and each of us takes a turn reading a line of the poem. Throughout the reading, we hear the poem's refrain:

> Alone, all alone
> Nobody, but nobody
> Can make it out here alone. (p. 74)

Our shared reading brings the poem to life. After we complete the round of reading, we talk about how our different voices and ways of speaking affect the meaning of the poem. As we interpret metaphors in the poem, students become aware of the relationships between the poem, their learning community, and the social issues they are studying in the other courses. Next, students get into small groups to plan readings of "Alone." Each group has half an hour to plan and rehearse before they perform the poem for the rest of the class. The groups enact the poem in many different ways, such as moving in a circle as they speak, standing at the back of the audience to deliver the lines, repeating lines, speaking in unison, and singing.

Next, students bring in poems or songs that are important to each of them. The topics of students' poems or lyrics, which are treated as if they were poetry, include subjects like war, inner-city life, life choices, love relationships, and peace. Poets may include Langston Hughes, Sojourner Truth, or Robert Frost, and the song lyrics might be by performers such as Loryn Hill, Nas, Tupac Shakur, and even Johnny Cash. Some brave students bring in poetry they wrote themselves, and a few choose to read poetry in their native languages. To prepare for individual readings, students practice reading with a partner in class, and they also practice at home.

On the next class day, each student stands at the front of the room and reads his or her choice to the whole class. Many students incorporate movement with their reading, some use rap rhythms and gestures, and a few sing. Risa read a poem dedicated to her mother in her native country. Later, she reflected about what it was like to hear her classmates do spoken word:

> The class environment was quiet and focused which made me personally very comfortable. Everyone was respectful of each other. That was nice. We all listened to each other, which is unusual. It was weird how I could see people's personalities in their poems. Even the way they read or the topic of their poem matched a lot with how they are. It was almost like I could tell whose poems belonged to whom if all the poems were piled together. It was a unique activity, it was fun and required us to focus.

Mini-performances. During the last part of the semester, students go through a series of small group mini-performances to prepare for their final performances. Students have about 40 minutes to plan and rehearse before presenting their 3-minute performances to the rest of the class. I assign certain constraints, such as not using words, using only three words, or using particular props. Each group chooses a social theme that shapes its work. Risa joined a group with an African American male, a European American male, and another Asian American female who decided to focus on the theme of racism and sexism. Other groups chose gay-lesbian-transgender issues, education, and other aspects of racism.

Rather than being literal skits with plots, the mini-performances focus on metaphors, which means that lighting, movement, sound, space, and images are as important as words in expressing ideas. Although there is an element of childlike play, it is a difficult assignment, for students have to work together to generate divergent ideas, negotiate with each other, and evaluate their work. There are often moments of frustration as students look to me for external structure before they find their own. Students' work is most effective if they stand up and physically try out their ideas rather than sitting and talking about them.

In one mini-performance, I ask students to express their theme without speaking, and I give each group audio-visual equipment to incorporate in their performance. Risa's group received an overhead projector, blank transparency, and marker. Risa, Nate, Mai, and Jason lined up chairs as if they were at a bus stop. As they took turns sitting next to each other, they showed obvious fear or dislike directed toward the person of a different race sitting next to them. On the wall behind them, they projected overhead transparencies of the characters' thoughts about sitting next to people of a different race, such as: "He's Black. He might steal my purse." The group's methods were effective, for it was disturbing to see these bigoted thoughts projected large on the wall. Risa wrote about their silent mini-performance:

> It wasn't too hard for our group to do a presentation not talking! However, rather than using words like before, we had to use actions, which was interesting. The audience had to pay more attention that way b/c most people are used to getting messages through what they have been told rather than what they are shown. This time we had to show not tell which I think is more powerful to make our audience get our message.

Final performance. To prepare for the end-of-semester performance, each group writes a short paper about the ideas they intend to express in their final work. Risa's group planned to examine "issues of racism as well as sexism, specifically, internalized oppression and interpersonal discrimination." They described their goals:

> We will be dealing with and exposing stereotypes in an attempt to dissolve them. . . . Delving into our personal experiences, such as Nate being a Black athlete, Jason as a White male at the top of the food chain, so to speak, and Risa and Mai's experiences as minority women. The best way to get people to think about something is to throw it at them, to make them examine themselves and question what they have been taught. . . . We [hope to] get our audience to get the "aha" thought running through their heads, and feeling the same emotions inside themselves as we display on stage. Through passion and intensity, and music and poetry, we will open up eyes and minds to serious issues.

After many hours of difficult discussion and practice, Risa's group juxtaposed several situations and readings to create a performance about racism and sexism in private lives, which they titled "Behind Closed Doors." They started with a scene with the two men—one Black and one White—watching a basketball game and having a heated discussion about who was allowed to use the "n" word; then they shifted to a kitchen scene in which one woman encouraged another to leave her abusive marriage. The next scene featured Mai sitting on a couch quietly reciting the poem, "Alone." The performance segued into a frozen action pose of Jason hitting his "wife" while Risa stood to the side reciting facts about domestic abuse and reading Ntozake Shange's (1995) poem, "Every Three Minutes." To finish, Jason sat on a stool and gave a chilling spoken word performance of the lyrics of "Wolves" by a rap group named Dead Prez (2000), which uses poetic metaphor to suggest that oppressed people are lured into extinction by the riches of the dominant culture.

As she performed with her group and watched other performances, Risa was part of a community of students who were feeling, imagining, and discovering together. As performers and audience, all of the students in the class shared a common mission to create meaning. The other woman in Risa's group, Mai, reflected about the experience:

> I couldn't believe how much effort was put into this. I was so happy to see so many peoples [*sic*] talents and I almost cried because I was so touched. Today I saw everything we've learned put into the two hours and I couldn't believe what an amazing performance we did. At first, I was very nervous and found no way to release any stress. I forgot one important part & it all came back to me when I told Nate I was nervous. He replied just remember, we live this everyday, just act like you livin' a normal day. That was what pushed me to have so much courage and I will always remember our group to be strong that way.

Constructing a Philosophy of Art: "Am I an Artist?"

Although students often enter the class believing that art should be a realistic picture of something familiar and pleasant, like a Monet painting of a landscape, they broaden their definitions of art over the semester. Risa wrote:

> Learning about art, different kinds of art has taught me that everything is an art or can be an art. I have found even our thinking process is a process of art. Or rather art is the part of our thinking process. Whether it's a painting, a plain drawing, a poem or a movie. One can get some sense out of the art as to how the artist is.

Risa also rethought her ideas about who is an artist:

> Today's class made me think of a question that I didn't think before! Am I an artist? I figured that everyone is an artist in a way. Everyone has their own unique talents and attributes that make them artists. So, I guess I am an artist too. There are lots of artists in this world. Many are well known and many more are anonymous. They are hidden by their mask, which covers the artistic side. Meaning they are behind the mask. Many of the artists don't ever realize the true artist inside them.

In her writing, Risa showed that she had developed an understanding of the complex, sometimes ambiguous nature of the arts:

> Thus, I definitely see growth in my understanding of art. Now, I try to analyze most things I see. I try to think why would an artist create something like that. What was it he/she had on his/her mind? I try to get the abstract meaning of the piece rather than just what is visible such as the color combination, its features and its words. I also try to see the bigger picture of it, not a smaller portion of it. Art doesn't require any specific format like math or science. It doesn't require proper steps or reasons, it can be the smallest and quickest thing but can have the biggest and the most complicated meaning behind it. Or it can be something that takes the longest time to create but have a very simple meaning.

Teaching Artistic Content and Processes

Teachers in many kinds of courses often ask students to "do something creative," but they may find that students do a lackluster job, become frustrated, or are resistant. Part of the problem might be an overly broad use of the word "creative," so that students are leery of it or do not know what it means. Some students are self-conscious about creating work that is technically less sophisticated than the quality of their ideas. Other students experience cognitive, cultural, emotional, and social "blocks" that inhibit them from engaging fully in creative processes (Cropley, 1992; James, 1999–2000; Jones, 1993). A number of students fear embarrassment in front of their peers, especially if they perceive themselves to be "uncreative" or "not artistic." Students who look for absolute answers, or who are used to lectures and multiple choice tests, may not recognize open-ended, self-constructed, or collaborative learning as real education (Baxter Magolda, 1992).

Conditions for Creativity

In this section, I suggest conditions that help students at all levels of experience learn to make sense of and value the arts and creative processes. These conditions are relevant to art-specific courses, but they also apply to courses in which students are asked to construct meaningful connections between their own experiences and disciplinary concepts. Aesthetic, metaphoric, creative, critical, and social processes are foregrounded so that students develop skills and attitudes that will help them do meaningful work.

Personal meaningfulness. Students are more likely to take risks in their work and to create something in which they are invested if they think that what they are doing is authentic and self-expressive, that it is contributing to a greater good, and that the process itself is worth doing. Strategies for helping students develop personal meaning in their work include metaphoric ("I am") writing and experiential exercises that emphasize students' awareness of their own emotions, senses, and bodies. Ongoing reflection, whether through writing or discussion, helps students understand the relevance of the assignments to their own lives and academic goals and promotes transfer to other educational situations (Perkins, 1994).

Supportive social environment. It is important to think of the classroom as a place in which students and teachers are mutually engaged in a shared mission to give meaning to their lives. A sense of community in the classroom encourages confidence, risk-taking, feedback, and an understanding of the arts as shared forms of expression. When there are multiple opportunities for collaboration, students give voice to their own experiences and develop empathy with others. Strategies for establishing a creative community include discussing the value of shared learning and acknowledging students' knowledge and artwork as an important part of course content.

Open, well-structured assignments. Many students are more accustomed to working with presented problems than with problems they formulate themselves. It is valuable, therefore, to design a variety of exercises and assignments that give students developmental practice with ambiguous assignments. There should be multiple opportunities for students to receive feedback on various aspects of their work, to critique their own and others' work, and to experience success. Because students sometimes have difficulty managing time and following through on projects, meaningful constraints such as deadlines, materials, or themes help them focus their thinking. Assignments should be intellectually challenging but not technically difficult, and they should be open-ended enough so that students can develop their own ideas and methods of working.

Explicit teaching of creative processes. By modeling creative thinking and behavior, showing diverse examples of creative work, incorporating activities that ask students to reflect about their creative process, and building in accountability for all stages of creativity, teachers can help students understand that creativity is both orderly and unpredictable. Developmental practice with strategies such as brainstorming, doing thumbnail sketches, elaborating on a theme, generating multiple interpretations, and doing non-graded exercises before graded assignments helps students gain confidence in their own ability to go beyond their familiar boundaries. Exercises that promote play, spontaneity, and unpredictable ways of thinking help students develop their imaginations. Books such as *Fanning the Creative Spirit* (Girsch & Girsch, 1999) and *The Creative Spirit* (Goleman, Kaufman, & Ray, 1993) provide concrete suggestions for developing creative strategies and attitudes.

Teaching for Creativity

Teaching for creativity is an unpredictable process that requires imagination, flexibility, comfort with ambiguity, personal vulnerability, and an appreciation that students are creating something that has never before been seen or heard in quite that way. Students' work often brings up unexpected issues and presents information in challenging ways that can enrich course content if the teacher is able to make use of this emerging information (James, 2002–2003). Teaching itself becomes a creative process, complete with the joy of new discoveries, the satisfaction of making meaningful connections among seemingly disparate kinds of information, and the potential for understanding students—and oneself—in new ways.

There may be a number of difficulties in teaching for creativity, however. Although the openness and complexity of creative processes generate excitement about learning, these qualities bring unpredictability to teaching that can be problematic. If a teacher is not comfortable with creative thinking and has set outcomes in mind rather than allowing for open-ended, unpredictable products, students will work toward the teachers' expectations rather than exploring new territory. Another problem is the tension between course content and creative processes, especially in content-based courses like biology in which specific concepts need to be covered. This conflict may be alleviated by pairing content-based and arts-based courses in learning communities. A third problem is students' difficulty in thinking of the creative arts as "real" learning. Explicit discussions with students about constructivist theories of learning can help them value creative processes as an important part of their education.

Evaluation

Although assessing students' learning in art—especially student-made artwork—may seem to be difficult, there are numerous strategies that teachers can use to give students feedback and grade their work. In courses in which making art is the primary focus, grades can be based on artistic qualities, on specific aspects of creative process such as divergent thinking and elaboration, or on how well the work solves a particular conceptual or formal problem. In the photomontage assignment, for example, the assignment handout describes the qualities of a good photomontage, including unified composition, good craftsmanship, graphic interest, and evidence of a range of creative strategies. Grades are based on how well students accomplish these qualities in their work and on written reflections about their creative process.

In courses in which artistic expression demonstrates content learning, such as Mark Pedelty's anthropology class, teachers often ask for a written report about how the work relates to the course concepts. These papers may be process papers about how the work was created or expository papers explaining the relationship of the work to the concepts being studied (Pedelty, 2001). In Karen Miksch's class, students receive participation points for their adaptations of *Antigone*, but it is expected that their performances will lead to a greater understanding of concepts in their graded work. In the "Do Something Cool" biology assignment, students complete a form in which they describe their project, explain why they chose to do it, and indicate how many points they think they should receive. Jensen uses this information to help him assign points. He wrote that because the range of possible approaches to this kind of assignment is so broad, it is often easier to spot poor quality projects that "include little detail, thoughtful planning, or time investment" (Jensen et al., 2003, p. 32) than it is to identify specific criteria for excellence.

The Arts in Developmental Education

Over the years, GC has been a rich environment for experimentation with using the arts in developmental education. Students in courses that are specifically about the arts have learned to think critically about ways that the arts express the ideas, emotions, and experiences of people who are both alike and very different from them. Students taking courses as diverse as math, psychology, and anthropology have used the arts to better understand the disciplinary concepts of the course. Students in hands-on art courses have used the arts to express their own thoughts, emotions, and experiences. In each case, the arts have added dimensions of knowing that are not found in reading, writing, or test-taking by themselves. Through the arts, students have had opportunities to develop a repertoire of ways of knowing and representing knowledge. The arts also provide innovative teaching methods, multicultural content, and alternative ways to assess students' knowledge.

In addition to the various ways that the arts have been used in the GC curriculum, there are many possibilities for how the arts may be used in the future, both in the college and in other educational settings. One direction that merits continued exploration is combining art-making with other content courses in learning communities. Evolving technologies make it easier for students to create their own visual art, music, photographs, Web sites, and videos in many kinds of courses. In addition, community outreach programs can extend the arts beyond the classroom, such as when Mark Pedelty's freshman seminar visited a school in Minneapolis to give a performance about Aztec myths and music (Weber, 2001, p. 7).

Studying about, through, and with the arts promotes integrative, embodied thinking that goes beyond traditional divisions of mind, body, and emotions. The arts heighten a sense of belonging and help students express and understand their own identities. Students learn to perceive themselves as people who are capable of thinking creatively and expressing ideas and experiences in multiple ways. They develop an awareness of the significance of their own actions in relation to others and of their ability to shape their education meaningfully.

It seems fitting to end with a quote from Risa about how her new understanding of art interconnects with her search for meaning in her life:

> There is no rule with art and that is what makes it the most creative topic of all. You can turn sideways, upside down, reverse an art and still have a meaning to it. Art is the hidden meaning of life. Only if people learned to see things from other angles, from the other side things would be so much better. So, to me a person's understanding of art can help he/she understand life much better. Not that I am saying I understand life now. I have begun the process of understanding art as I am with life.

References

Alland, A., Sr. (1974). *Jacob A. Riis: Photographer & citizen*. Millerton, NY: Aperture.

Almereyda, M. (Director). (2000). *Hamlet* [video]. New York: Miramax.

Amabile, T. (1983). *The social psychology of creativity.* New York: Springer-Verlag.

Angelou, M. (1994). Alone. In *The complete collected poems of Maya Angelou* (pp. 74–75). New York: Random House.

Antubam, K. (1963). *Ghana's heritage of culture*. Leipzig,Germany: Koehler & Amelang.

Association of American Colleges and Universities. (2002). *Greater expectations: A new vision for learning as a nation goes to college.* Washington, DC: Author.

Ball, A., & Heath, S. B. (1993). Dances of identity: Finding an ethnic self in the arts. In S. B. Heath & M. W. McLaughlin (Eds.), *Identity and inner-city youth: Beyond ethnicity and gender* (pp. 13–35). New York: Teachers College Press.

Baxter Magolda, M. (1992). *Knowing and reasoning in college*. San Francisco: Jossey-Bass.

Beach, R., Lundell, D. B., & Jung, C. (2002). Developmental college students' negotiation of social practices between peer, family, workplace, and university worlds. In D. B. Lundell & J. L. Higbee (Eds.), *Exploring urban literacy & developmental education* (pp. 79–108). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Bleedorn, B. (1998). *The creativity force in education, business, and beyond.* Lakeville, MN: Galde Press.

Branagh, K. (Director). (1996). *Shakespeare's Hamlet* [video]. Beverly Hills, CA: Columbia Pictures, Castle Rock Entertainment, and Columbia TriStar Home Video.

Caine, R. N., & Caine, G. (1997). *Education on the edge of possibility.* Alexandria, VA: Association for Curriculum and Development.

Cromer, J. (1990). *Criticism: History, theory and practice of art criticism in art education*. Reston, VA: National Art Education Association.

Cropley, A. (1992). *More ways than one: Fostering creativity*. Norwood, NJ: Ablex.

Dancing in one world [video]. (1993). New York: Thirteen/WNET and RM Arts.

Daughters of the Anasazi [video]. (1990). Taos, NM: Film Project.

Dead Prez. (2000). Wolves. On *Let's get free* [CD]. New York: Loud Records.

Edupoetic Enterbrainment. (n.d.). Retrieved September 16, 2004, from http://www.edupoetic.com/ home.htm

Edwards, B. (1989). *Drawing on the right side of the brain: A course in enhancing creativity and artistic confidence* (rev. ed.). New York: J. P. Tarcher.

Eglash, R. (2002). *African fractals, modern computing, and indigenous design.* New Brunswick, NJ: Rutgers University.

Eglash, R. (2003). *Culturally situated design tools: Teaching math through culture*. Retrieved September 20, 2004, from http://www.rpi.edu/~eglash/csdt.html

Edwards, P. (Ed.). (1985). *Hamlet, Prince of Denmark.* New York: Cambridge University Press.

Eisner, E. W. (1998). Does experience in the arts boost academic achievement? *Art Education, 51* (1), 7–15.

Eisner, E. (2002). *The arts and the creation of mind.* New Haven, CT: Yale University Press.

Eldredge, S. (1996). *Mask improvisation for actor training and performance.* Evanston, IL: Northwestern University Press.

Feinstein, H. (1996). *Reading images: Meaning and metaphor.* Reston, VA: The National Art Education Association.

Freedman, K. (2003). *Teaching visual culture.* Reston, VA: National Art Education Association.

General College. (1938). *Report on problems and progress of the General College*. Unpublished manuscript, University of Minnesota, Minneapolis.

General College. (1968). *The General Education Sounding Board, V* (1). Minneapolis, MN: University of Minnesota.

Girsch, M., & Girsch, C. (1999). *Fanning the creative spirit: Two toy creators simplify creativity.* St. Paul, MN: Creativity Central.

Goldberg, M. (1997). *Arts and learning: An integrated approach to teaching and learning in multicultural and multilingual settings.* San Marcos, CA: California State University.

Goleman, D., Kaufman, P., & Ray, M. (1993). *The creative spirit*. New York: Plume.

Gordon, W. J. J. (1973). *The metaphorical way of knowing & learning* (2nd ed.). Cambridge, MA: Porpoise Books.

Greene, M. (2001). *Variations on a blue guitar: The Lincoln Center Institute lectures on aesthetic education.* New York: Teachers College Press.

Gruber, H. E. (1989). The evolving systems approach to creative work. In D. B. Wallace & H. Gruber, *Creative people at work: Twelve cognitive case studies* (pp. 3–24). New York: Oxford University.

Hicks, S. (2000). *Snow falling on cedars* [video]. Hollywood, CA: Universal Studios.

Hill, G. (1940). The general arts. In *Curriculum making in the General*

College (188–210). Unpublished manuscript, University of Minnesota, Minneapolis.

Hughes, J. (1985). *The breakfast club* [video]. Hollywood, CA: Universal Studios.

Hurwitz, A. (1993). *Collaboration in art education.* Reston, VA: National Art Education Association.

Islamic art [video]. (1988). Princeton, NJ: Films for the Humanities.

James, P. (1999). Ideas in practice: The arts as a path for developmental student learning. *Journal of Developmental Education, 22*(3), 22–28.

James, P. (1999–2000). Blocks and bridges: Learning artistic creativity. *Arts and Learning Research Journal, 16*(1), 110–133.

James, P. (2000a). "I am the dark forest": Personal analogy as a way to understand metaphor. *Art Education, 53*(5), 6–11.

James, P. (2000b). Working toward meaning: The evolution of an assignment. *Studies in Art Education, 41*(2), 146–163.

James, P. (2002). Ideas in practice: Fostering metaphoric thinking. *Journal of Developmental Education, 25*(3), 26–28, 30, 32–33.

James, P. (2002–2003). Between the ideal and the real: A reflective study of teaching art to young adults. *Arts & Learning Research Journal, 19* (1), 1–22.

James, P., & Haselbeck, B. (1998). The arts as a bridge to understanding identity and diversity. In P. L. Dwinell & J. L. Higbee (Eds.), *Developmental education: Meeting diverse student needs* (pp. 3–20). Morrow, GA: National Association for Developmental Education.

Jensen, M. (2004). *"Do Something Cool" projects for GC 1135*. Retrieved May 15, 2004, from http://www.gen.umn.edu/faculty_staff/jensen/1135/example_student_projects/

Jensen, M., Moore, R., Hatch, J., & Hsu, L. (2003). Ideas in practice: A novel, "cool" assignment to engage science students. *Journal of Developmental Education, 27*(2), 28–33.

John-Steiner, V. (1997). *Notebooks of the mind: Explorations of thinking.* New York: Oxford University Press.

Jones, L. (1993). Barriers to creativity and their relationship to individual, group, and organizational behavior. In S. G. Isaksen, M. C. Murdock, R. L. Firestien, & D. J. Treffinger (Eds.), *Nurturing and developing creativity: The emergence of a discipline* (pp. 133–154). Norwood, NJ: Ablex.

Kindred spirits [video]. (1990). Washington, DC: Smithsonian.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought.* New York: Basic Books.

LeSeur, M. (2002). Women on the breadlines. In P. Lauter (Ed.), *The Heath anthology of American literature,* Volume II (4th ed.; pp. 1807–1811). Boston: Houghton-Mifflin.

Morris, E. (Director). (1988). *The thin blue line* [video]. New York: Miramax.

Opitz, D. (2004). Story teller. *Access, 3*(3), 8–9.

Paivio, A., & Walsh, M. (1993). Psychological processes in metaphor comprehension and memory. In A. Ortony (Ed.), *Metaphor and thought* (pp. 307–328). Cambridge, UK: Cambridge University.

Palmer, P. (1999). The grace of great things: Reclaiming the sacred in knowing, teaching, and learning. In S. Glazer (Ed.), *The heart of learning: Spirituality in education* (p. 17). New York: Jeremy P. Tarcher.

Pedelty, M. (2001). Jenny's painting: Multiple forms of communication in the classroom. In B. L. Smith & J. McCann (Eds.), *Reinventing ourselves: Interdisciplinary education, collaborative learning, and experimentation in higher education* (pp. 230–249). Bolton, MA: Anker.

Pedelty, M. (2004a). *GC 1312 Syllabus.* Unpublished manuscript, University of Minnesota, Minneapolis.

Pedelty, M. (2004b). *GC 1903 Syllabus.* Unpublished manuscript, University of Minnesota, Minneapolis.

Pedelty, M. (2004c). Ritual and performance. In P. Rice & D. McCurdy (Eds.), *Strategies for teaching anthropology* (pp. 150–154). Upper Saddle River, NJ: Prentice Hall.

Perkins, D. (1994). *The intelligent eye: Learning to think by looking at art.* Santa Monica. CA: The Getty Center of Education in the Arts.

A photo essay on the Great Depression. (2002). In *Modern American poetry.* Retrieved on September 30, 2004, from http://www.english.uiuc.edu/maps/depression/photoessay.htm

Public sculpture: America's legacy [video]. (1994). Washington, DC: National Museum of American Art, Smithsonian Institution.

Pugh, S. L., Hicks, J. W., & Davis, M. (1997). *Metaphorical ways of knowing: The imaginative nature of thought and expression.* Urbana, IL: National Council for Teachers of English.

Robertson, D., & Nelson, C. (1976). *Mathematics and art.* Unpublished manuscript, University of Minnesota, Minneapolis.

Root-Bernstein, R., & Root-Bernstein, M. (1999). *Sparks of genius: The thirteen thinking tools of the world's most creative people.* Boston: Houghton-Mifflin.

Root-Bernstein, R., & Root-Bernstein, M. (2000). Learning to think with emotion. *Chronicle of Higher Education, 46*(19), A54.

Rose, T. (1994). *Black noise: Rap music and Black culture in contemporary America.* Middletown, CT: Wesleyan University Press.

Rothenberg, P. S. (Ed.). (1995). *Race, class, and gender in the United States: An integrated study* (3rd ed.). New York: St. Martin's Press.

Roukes, N. (1982). *Art synectics: Stimulating creativity in art.* Worcester, MA: Davis.

Sanders, D. A., & Sanders, J. A. (1984). *Teaching creativity through metaphor: An integrated brain approach.* New York: Longman.

Sapphire. (1997). *Push.* New York: Random House.

Scorsese, M. (Director). (1976). *Taxi driver* [video]. Hollywood, CA: Columbia Pictures.

Shange, N. (1995). Every three minutes. In P. S. Rothenberg (Ed.), *Race, class, and gender in the United States: An integrated study* (3rd ed.; pp. 236–238). New York: St. Martin's Press.

Sophocles (442 B.C.E.). *Antigone* (R. C. Jebb, Trans.). Retrieved October 2, 2004, from http://classics.mit.edu/Sophocles/antigone.html

Spolin, V. (1994). *Improvisation for the theater* (5th ed.). Evanston, IL: Northwestern University Press.

Sweet, A. P. (1997). A national policy perspective on research intersections between literacy and the visual/communicative arts. In J. Flood, S. B. Heath, & D. Lapp (Eds.), *Handbook of research on teaching literacy through the communicative and visual arts* (pp. 264–285). New York: Macmillan Library Reference USA.

Takaki, R. (1993). *A different mirror: A history of multi-cultural America*. New York: Little Brown.

Taylor, D. (2001). From the Dean. *Access, 1*(1), 2. Minneapolis, MN: General College, University of Minnesota.

Taylor, D. (1986). *Sophocles, the Theban plays* [video], translation by D. Taylor. Princeton, NJ: Films for the Humanities.

Tinto, V. (2002, February). *Taking student learning seriously.* Keynote address presented at the Southwest Regional Learning Communities Conference, Tempe, AZ. Retrieved June 4, 2004, http://www.mcli.dist.maricopa.edu/events/lcc02/presents/tinto.html

Tharp, T. (2003). *The creative habit: Learn it and use it for life.* New York: Simon & Schuster.

Tornatore, G. (Director). (1989). *Cinema paridiso* [video]. New York: Miramax.

Urban Bushwomen. (1996). *Women's work* [video]. Richmond, VA: Virginia Museum of Arts.

Wacipi-PowWow [video]. (1995). Saint Paul, MN: Twin Cities Public Television.

Weber, L. (2001). GC and the arts. *Access, 1*(1), 4–9. Minneapolis, MN: General College, University of Minnesota.

Weisman Art Museum. (2004). *Architecture and history*. Retrieved September 26, 2004, from http://www.weisman.umn.edu

Yenawine, P. (1991). *How to look at modern art*. New York: Harry Abrams.

CHAPTER 14

Overview of the General College Mathematics Program

D. Patrick Kinney, Douglas F. Robertson, and Laura Smith Kinney

ABSTRACT

The General College developmental mathematics program teaches elementary algebra and intermediate algebra using several different instructional models. This chapter provides a rationale for offering students an array of instructional models, along with a description of each model. The instructional models used are lecture, computer-mediated instruction, guided group discovery, active learning with a mastery approach, and cooperative learning with real-world problems. Students are allowed to self-select into the instructional model that they prefer. A mathematics placement test is used to determine if students should enroll in Elementary Algebra, Intermediate Algebra, or a higher-level course.

The developmental mathematics program at the General College offers noncredit-bearing mathematics courses along with a credit-bearing introductory statistics course. Each year approximately 17 sections of Elementary Algebra and 19 sections of Intermediate Algebra are offered. Class sizes range from 15 to 35 students in each course, depending on enrollment patterns, time of day, and teacher preferences. To meet the needs of students who place into arithmetic, along with those who desire more time to learn elementary algebra, the program offers Elementary Algebra Part I and Elementary Algebra Part II. This sequence splits elementary algebra into a two-semester sequence and includes topics from arithmetic. It also includes information about developing effective study skills, overcoming math anxiety, and becoming a successful student. Once students successfully complete Elementary Algebra Part I and Elementary Algebra Part II, or Elementary Algebra, they enroll in Intermediate Algebra. After successfully completing Intermediate Algebra students typically enroll in College Algebra or Precalculus, which are taught by the faculty of the Mathematics Department in the

Institute of Technology in a separate building on campus. Also, some students enroll in the introductory statistics course offered by the General College in order to meet the all-university Mathematical Thinking requirement.

The General College developmental mathematics program offers classes using a variety of instructional models and takes the position that no single instructional model is best for all students. This view is based on research on students' learning styles, which is discussed in the next section, and on feedback from students. The methods used to deliver developmental mathematics instruction at the General College are (a) lecture, (b) computer-mediated instruction, (c) guided group discovery, (d) active learning with a mastery approach, and (e) cooperative learning with an emphasis on "real-world" applications.

Rationale for Offering a Variety of Instructional Models

There is evidence that students benefit when they are able to learn using their preferred learning styles (Higbee, Ginter, & Taylor, 1991; Lemire, 1998). A commonly used definition of learning styles is that given by Galbraith and James (1987, pp. 27–28), who identified seven perceptual modes related to learning: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. However, as noted by Higbee, Ginter, and Taylor, "the connotations of the term 'learning style' are varied and in many instances divergent in nature" (p. 5).

We believe that the discussion of learning styles can be extended to include additional factors related to students' preferences for how they learn. Some students, for example, prefer a lecture class where the instruction is teacher-centered and the instructor "shows and explains everything" (Kinney, 2000). Other students, however, prefer instruction that is student-centered, such as when using software in a computer-mediated class. Students also vary in their preference for the pace of the instruction and the order in which material is presented. In a lecture class, the instructor exerts significant control over the pace of the instruction and the order in which the content is presented. In a computer-mediated class, however, students control the navigation path and the pace of instruction. These features are of particular interest to students who are able to learn significantly faster than the pace in a lecture class, to students who want more time to process the material, and to those who need a review after a lapse in their mathematics education.

The nature of the human interaction in a classroom is another important issue for many students (Kinney, 2000). Some students prefer that an instructor lead class discussions and activities, such as in a lecture class. This allows students to interact with the instructor as the mathematics is presented, and it allows students to "listen in on" the discussion between the instructor and other students. Further, students frequently enjoy working with classmates on in-class activities and benefit from the discussion with classmates. Not all students, however, prefer the type of interaction in a teacher-centered classroom. Students who do not like being called on in front of the whole class may be uncomfortable in a lecture class, especially if they think that the instructor does not interact with students in a caring and respectful manner. These students may opt for a computer-mediated class. We found that students in computer-mediated classes still value working with classmates, especially informally as they proceed through lessons on the software. Finally, students who believe that a typical mathematics instructor is able to explain the material well may opt for a traditional lecture class, while students who think that a typical mathematics instructor does not explain the material well may select a computer-mediated class or a class that involves a large amount of group work or student-to-student interaction.

An issue that is becoming increasingly important to many students is flexibility in how, where, and when they learn mathematics. In a traditional lecture class students have little flexibility. They are expected to learn the mathematics by following the instructor's presentation, asking questions, reading the textbook, and working with classmates. Further, they are expected to learn the mathematics at a specific location and at a specific time. That is, they are expected to learn the mathematics while in class during the hours that the class meets. For some developmental education students the structure of a typical lecture class works well. An effective alternative to a lecture class for some students is computer-mediated instruction. In a computer-mediated class, the primary source of instruction and feedback is interactive multimedia software. During class students are given access to the software, individual assistance from the instructor as needed, a textbook, and the flexibility to work with classmates as desired. Because the instructor does not lecture, he or she is available to work with students individually or in small groups throughout the entire class period. Thus, students in a computer-mediated class are frequently able to receive more individual assistance than students in a lecture class. We have found that in a computer-mediated class students with learning disabilities, who are often reluctant to ask questions in a lecture class for fear of being embarrassed or of "holding up the class" (Kinney, 2002), often value being able to work individually with the instructor for an extended period of time during class.

Methods of Instruction

We consider lecture instruction first because it is familiar to instructors and therefore provides a frame of reference for the remaining instructional models. Each year, approximately 14 of the 36 developmental mathematics sections taught in the General College use a traditional lecture approach.

Lecture

Direct instruction is typically used to deliver content in a lecture class. Rosenshine and Meister (1987) observed that direct instruction usually includes (a) presenting new material in small steps, (b) modeling of the procedure by the teacher, (c) thinking aloud by the teacher, (d) guiding initial student practice, (e) providing systematic corrections and feedback, and (f) providing expert models of the completed task. This type of instruction is teacher-centered, and the instructor is the primary source of new material. In addition to listening to the lecture, students may ask the instructor questions, work in pairs or groups, and take notes. The applications discussed in these classes are typically those found in mainstream textbooks.

Computer-Mediated Instruction

In a typical year, 14 of the 36 developmental mathematics sections offered in the General College are taught using computer-mediated instruction. We structured our computer-mediated courses in a manner that is consistent with the definition of computer-mediated instruction as stated by Gifford (1996). Gifford defined computer-mediated learning as a learner-centered model of technology-mediated instruction for which the software is the primary vehicle for delivering the instruction. The computer-mediated courses use interactive multimedia software from Academic Systems (2001) to deliver the instruction. The software (a) provides a thorough presentation of the concepts and skills using interactive multimedia, (b) imbeds items requiring student interaction within the instruction, (c) provides immediate feedback and detailed solutions, (d) includes provisions for the development of skills, (e) offers online quizzes, and (f) includes a course management system that tracks students' time on task and progress.

The instructor is a critical part of the students' learning experience even though he or she does not present the content. The instructor provides individual and small group assistance as needed, structures the course in a manner that promotes students' completing the lessons on time, and provides feedback to students about their understanding of the math and their progress in the course. A schedule is given to students at the beginning of the semester that indicates the lesson for each day, the homework problems that will be assigned and collected for grading, the due dates for all written assignments, and the dates of the quizzes and exams. Homework, quizzes, and exams are all completed using paper and pencil.

The software used in computer-mediated classes provides students with the flexibility to study mathematics "anywhere, anytime," provided they have a personal computer (PC), Internet access, and know how to use these resources to utilize the software. If a student in a regularly scheduled class misses a class, the student can study the day's lesson outside of class. Also, students who attended class can review the lesson outside of class or complete the lesson if they did not finish while in class. Kinney, Kinney, and Robertson provide further details about computer-mediated instruction in Chapter 15.

Guided Group Discovery

Dr. Susan Staats, Assistant Professor of developmental mathematics in the General College, uses a guided group discovery method in her classes. Her implementation of this method is motivated by authentic applications such as the spread and effects of human immunodeficiency virus (HIV) and malaria around the world. Although the focus in her classes is on conceptual learning, she also addresses the development of algebraic skills. Students work cooperatively in small groups and engage in whole-class discussions while the instructor acts as a moderator and coach using a Socratic method. In her classes, Dr. Staats poses problems, asks clarifying questions, and has students decide collaboratively when a math statement is true. In this method, the instructor does not act as the ultimate authority of right or wrong; rather, the mathematics is the authority.

In some class meetings Dr. Staats presents a specific situation or algebraic problem at the start of the class. Initially, students work on the problem in small groups while the instructor observes and interacts with the groups, asking questions but not evaluating responses or giving authoritative answers. Once the class members are brought together as a group to discuss their findings, the instructor acts as a moderator and facilitator, but never as the final authority. The instructor continues to ask questions, such as, "How did you come up with that result?" or "Do the data support that conjecture?" or "Can you elaborate a bit more along those lines?" Through these discussions, the students and instructor develop the general concepts, formulas, and procedures related to the situation or algebraic problem that was given. For the interested reader, Brissenden (1988) described this method in some detail in *Talking About Mathematics*. Dr. Staats provides further details in Chapter 10.

Active Learning With a Mastery Approach

Dr. Irene Duranczyk, General College Assistant Professor of developmental mathematics, teaches using a sociocultural theory model (Duranczyk, Staats, Moore, Hatch, Jensen, & Somdahl, 2004). Students take an experiential approach to new topics or ideas in beginning algebra, explore the topics in context in their own words, and then translate their experience to mathematical language and concepts. Authentic forms of assessment are built into the class through the use of student-centered projects.

As previously mentioned, the General College offers Introductory Algebra as a one-semester course but also offers it as a two-course sequence. In the two-course sequence, Dr. Duranczyk uses a mastery-based approach that incorporates active learning techniques, student projects, and multicultural contexts to help make the mathematics familiar and meaningful to students from diverse backgrounds. Also, information about math study skills, ways to reduce math anxiety, math as a social and cultural activity, and problem solving are infused throughout the class.

Active learning according to Meyers and Jones (1993) "involves providing opportunities for students to meaningfully talk and listen, write, read, and reflect on the content, ideas, issues, and concerns of an academic subject" (p. 6). The American Mathematical Association of Two-year Colleges (AMATYC) Standards (AMATYC, 1995, p. 9) promote active learning. These standards advocate that students (a) acquire the ability to read, write, listen to, and speak mathematics; (b) expand their mathematical reasoning skills as they develop convincing mathematical arguments; (c) engage in rich experiences that encourage independent, nontrivial exploration in mathematics; and (d) learn mathematics through modeling real-world situations.

A mastery-based approach consistent with Keller's (1968) instructional model called the personalized system of instruction (PSI) is incorporated into the courses taught by Dr. Duranczyk. The PSI model demands that students study material and take tests on the material until they are able to demonstrate mastery. When a student completes a test the instructor is often able to review the students' work and provide immediate feedback. The feedback, according to Kluger and DeNisi (1996), should be specific to the task, corrective, and done in a familiar context that shapes learning. The PSI instructional approach has been shown to be an effective method to achieve student success (Kulik, Kulik, & Bangert-Drowns, 1990).

Cooperative Learning With Real-World Problems

Dr. Donald Opitz, the General College Mathematics Center Coordinator, uses a cooperative-learning pedagogy in which the activities are based on "real-world" applications. The rationale for incorporating cooperative learning is that it can promote more positive relationships among students, higher math self-esteem, and more positive attitudes towards mathematics (Johnson & Johnson, 1989). The applications lead students through a series of questions that prompt them to consider what mathematical tools can be used to answer the questions. The algebra concepts and skills necessary to answer the questions are introduced, and students then use them to solve the problems embedded in the real-world applications.

Full class discussions, rather than traditional lectures, are used to clarify procedures and concepts. In addition, students spend one class period per week in a computer lab to work on skill development using computer software. Students engage in online discussion threads and complete online activities using WebCT outside of class. Course projects require students to work cooperatively outside of class to collect and analyze real data. Groups adopt a variety of presentation styles to communicate their findings within the class and demonstrate their mastery of algebra skills needed for their analyses. When groups present their findings in class, they demonstrate their understanding of which algebra concepts and skills are needed to analyze their real-world problem and how to apply them.

Placing Students Into Mathematics Courses

Information about the General College math program is sent to prospective students in late February along with other orientation materials and instructions on how to take the General College mathematics placement test, which is located on the University of Minnesota's Web site, (University of Minnesota math placement exam, n.d.). A user name and password is required to access the test. The placement test assists each student, along with the advisor and the mathematics faculty, in determining the appropriate level of mathematics for the student.

To help students prepare for the placement test, the General College sends students a set of practice questions, with answers, that are similar to the questions on the actual test. The placement test questions were derived from the mathematics courses offered by the General College. Students are encouraged to study before taking the test to refresh their memory so that they do not place into a course that is below the level for which they have sufficient preparation. However, not all prospective students review prior to taking the mathematics placement test or even understand the importance of doing their best when taking the placement test. Therefore, students are given the opportunity to take a second version of the placement test at a later date. Students may also talk to a mathematics professor about placement during summer orientation. The placement test provides a guide to the level of course in which students should enroll, but the final decision regarding course level is left to the individual student in consultation with his or her advisor.

After a student and his or her advisor have decided on the course level that is appropriate, the student selects an instructional format. Students are provided with information about the General College mathematics courses during their on-campus orientation and through the University Course Guide (University of Minnesota course guide, n.d.). To view the General College course descriptions, students select "General College" in the subject pull-down menu. Students discuss the instructional models and different learning styles with their advisor and then select the format that they prefer. No formal assessment of learning styles is given. Students may also talk one-on-one with a General College mathematics professor to obtain more information about the various instructional formats and levels. Ultimately, students must select the instructional format that they believe will best meet their preferences. This process gives students ownership of the decision about which instructional format they enroll in.

We are in the process of developing an inventory that may be used to assist students in deciding whether to enroll in a computer-mediated or non-computer-mediated class. The items in Figure 1 were developed based on written responses from students about their views of computer-mediated and lecture instruction. Figure 1 contains data on the responses from students who preferred the instructional format that they were enrolled in at both the start and end of the semester. Students selected one of the following responses for each item: 1 = disagree, 2 = more disagree than agree, 3 = more agree than disagree, or 4 = agree. A four-point scale, rather than a five-point scale, was used so that students could not select a neutral response. Therefore, mean scores ranged from 1 to 4 for each item. A mean less than 2.5 indicates that students tended to disagree more than agree with the item. A mean score greater than 2.5 indicates that students tended to agree more than disagree with the item.

The results of the inventory suggest that students in computer-mediated classes tend to prefer to learn independently using software, provided the software effectively incorporates interactive multimedia, allows students to control the pace and navigate flexibly, and provides step-by-step explanations. Students in computer-mediated sections value having an instructor available to answer individual questions, although they may have a hard time paying attention and feel bored if the instructor were to lecture. Students in lecture sections, on the other hand, think that the interaction in a lecture class holds their attention better than would the interactivity of software. They also tend to view software as a less effective way to learn mathematics than students in computer-mediated classes. The inventory results support the view that no single instructional format is best for all students.

	COURSE FORMAT	M	N	SD	SEM
1. It is important that I attend class if I want to do well in math.	computer lecture	3.43 3.54	81 183	0.87 0.75	0.10 0.06
2. The structure and organization of this class has helped me do well.	computer lecture	3.43 3.39	81 183	0.61 0.67	0.07 0.05
3. I prefer to learn by watching a teacher lecture and being able to ask questions during the lecture.	computer lecture	3.73 3.63	79 183	0.52 0.67	0.06 0.05
4.* I would prefer to take a computer-based math class if an instructor were available to answer my questions fairly quickly.	computer lecture	3.73 1.65	81 183	0.50 0.86	0.06 0.06
5.* I would take a computer-based math class if the computer provided detailed step-by-step explanations on how to do problems.	computer lecture	3.37 2.04	81 182	0.73 1.06	0.08 0.08
6.* I would learn much better if I could control the pace at which the mathematics is presented.	computer lecture	3.85 2.80	81 182	0.36 0.96	0.04 0.07
7.* It would be helpful if I could go back and see explanations given earlier.	computer lecture	3.90 3.23	81 182	0.30 0.72	0.03 0.05
8.* A multimedia program for teaching math provides more visual ways to learn than a teacher lecturing.	computer lecture	3.80 2.09	81 181	0.49 0.93	0.05 0.07
9.* I prefer to learn more on my own using software rather than having a teacher show me everything.	computer lecture	3.72 1.55	81 181	0.48 0.76	0.05 0.06
10.* A good interactive multimedia computer program holds my attention better than a math teacher.	computer lecture	3.59 1.48	81 182	0.59 0.69	0.07 0.05
11.* I have a hard time paying attention and feel bored when a teacher lectures about math.	computer lecture	3.54 1.82	81 181	0.69 0.84	0.08 0.06
12.* A lecture math class has more interaction that helps me learn than a computer class using interactive multimedia software.	computer lecture	1.90 3.48	81 182	1.02 0.77	0.11 0.06

Note. $*p < 0.05$.

Figure 1. Inventory related to computer-mediated and lecture instruction.

The Mathematics Center

The Mathematics Center is coordinated by Dr. Donald Opitz. It provides free walk-in mathematics tutoring 35 hours per week in the same building that classes are held. The Mathematics Center contains reference books and five computers that can be used for mathematics-related activities. Students with additional individual needs may sign up with a tutor to receive one-on-one assistance throughout the semester.

The Mathematics Center works closely with the mathematics instructors to provide effective support for students. The tutors are undergraduate students, many of whom have completed mathematics courses at the General College. Tutors receive training throughout the academic year regarding how to be an effective tutor. Further, information regarding the content covered in the General College mathematics courses and the instructional models used to teach the mathematics are included in the tutor training.

Dr. Opitz also coordinates a Supplemental Instruction program for General College mathematics courses that provides students with structured assistance from tutors in a classroom-like setting. Students may sign up for free Supplemental Instruction in their regularly-scheduled classes. Every effort is made to make the sessions available at times that are convenient for students, including evenings. Further information about the Mathematics Center is provided in Chapter 23.

Summary

The General College developmental mathematics courses are taught using a variety of instructional models. Our view is that no single instructional model is best for all students and that students should be allowed to self-select into the instructional model of their choice. Each of our classes incorporates a developmental education approach and strives to provide an environment that fosters students' learning the mathematics, prepares students for subsequent mathematics courses, improves students' attitudes towards learning mathematics, and enhances student retention. Looking forward, we anticipate that we will continue to experiment with new ways to deliver developmental mathematics instruction and that we will learn from our colleagues and our students in the process.

References

Academic Systems. (2001). *Interactive mathematics* [computer software]. Bloomington, MN: Plato Learning.

American Mathematical Association of Two-Year Colleges. (1995). *Crossroads in mathematics: Standards for introductory college mathematics before calculus*. Memphis, TN: Author.

Brissenden, T. (1988). *Talking about mathematics*. Oxford, UK: Basil Blackwell.

Duranczyk, I. M., Staats, S., Moore, R., Hatch, J., Jensen, M., & Somdahl, C. (2004). Introductory-level college mathematics explored through a sociocultural lens. In I. M. Duranczyk, J. L. Higbee, & D. B. Lundell (Eds.), *Best practices for access and retention in higher education* (pp. 43–53). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Galbraith, M. W., & James, W. B. (1987). The relationship of educational level and perceptual learning styles. *Journal of Adult Education, 15*(2), 27–35.

Gifford, B. R. (1996). *Mediated learning: A new model of technology-mediated instruction and learning.* Mountain View, CA: Academic Systems.

Higbee, J. L., Ginter E. J., & Taylor W. D. (1991). Enhancing academic performance: Seven perceptual styles of learning. *Research & Teaching in Developmental Education, 7*(2), 5–9.

Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Edina, MN: Interaction Book.

Keller, F. (1968). "Goodbye teacher . . ." *Journal of Applied Behavioral Analysis, 1*(1), 79–89.

Kinney, D. P. (2000). *Student responses to survey, questionnaire, and focus group questions identifying reasons for students' enrollment in computer-mediated and lecture courses*. Unpublished raw data. Minneapolis, MN: University of Minnesota.

Kinney, D. P. (2002). Students with disabilities in mathematics: Barriers and recommendations. *The AMATYC Review, 23*(2), 13–23.

Kluger, A., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*, 254–284.

Kulik, C., Kulik, J., & Bangert-Drowns, R. (1990). Effectiveness of mastery learning programs: A meta-analysis. *Review of Educational Research, 60*, 265–299.

Lemire, D. S. (1998). Three learning styles models: Research and recommendations for developmental education. *The Learning Assistance Review, 3*(2), 26–40.

Meyers, C., & Jones, T. (1993). *Promoting active learning.* San Francisco: Jossey-Bass.

Rosenshine, B., & Meister, C. (1987). Direct instruction. In M. J. Dunkin (Ed.), *The international encyclopedia of teaching and teacher education* (pp. 359–364). Oxford, UK: Pergamon.

University of Minnesota course guide. (n.d.). Minneapolis, MN: University of Minnesota Retrieved January 4, 2005, from http://onestop2.umn.edu/courseinfo/courseguide_selectsubject.jsp?institution=UMNTC

University of Minnesota math placement exam. (n.d.). Minneapolis, MN: University of Minnesota Retrieved January 4, 2005, from http://www.onestop.umn.edu/placement

CHAPTER 15

Learning Mathematics Through Computer-Mediated Instruction

D. Patrick Kinney, Laura Smith Kinney, and Douglas F. Robertson

ABSTRACT

Computer-mediated mathematics instruction provides students with an alternative to lecture instruction. The interactive multimedia software presents the concepts and skills, provides feedback, and includes a course management system. The instructor works with students individually or in small groups throughout each class period to address students' questions and to provide feedback. This chapter presents an overview of computer-mediated software, along with details about how our computer-mediated courses are structured. Research regarding student outcomes in computer-mediated courses is also provided. Finally, trends in computer-mediated instruction are discussed.

The structure of the computer-mediated courses at the General College is consistent with the definition of computer-mediated instruction stated by Gifford (1996). Gifford defined computer-mediated learning as a learner-centered model of technology-mediated instruction for which the software is the primary vehicle for delivering the instruction. Software that supports computer-mediated instruction makes use of interactive multimedia. Najjar (1996) defined multimedia as the use of text, graphics, animation, pictures, video, and sound to present information. Interactivity allows students to control both the pace of the learning and the navigation path. Najjar examined the research related to interactivity and stated, "Interactivity appears to have a strong positive effect on learning (Bosco, 1986; Fletcher, 1989, 1990; Verano, 1987)" (p. 131). Reviews of research on the impact of technology-mediated instruction on student learning have consistently found that technology-mediated instruction can have positive effects on student learning (Becker, 1992; Khalili & Shashaani, 1994; Kulik & Kulik, 1991; Niemiec, Samson, Weinstein, & Walberg, 1987).

Bagui (1998) examined how multimedia makes it easier for people to learn because of parallels between multimedia and the "natural" way people learn according to the information process theory. The information processing theory is defined by Bagui as a theory that shows how people learn. The reasons for increased learning with multimedia according to Bagui include (a) interactivity, (b) flexibility, (c) rich content, (d) motivational effects, (e) better structured instruction, (f) immediate feedback, and (g) material presented in a more stimulating fashion. The success of multimedia can be attributed mainly to dual coding according to Bagui. Dual coding theory asserts that information is processed through one of two generally independent channels, verbal or nonverbal (Clark & Paivio, 1991). Bagui stated that learning is better when information is processed through two channels, such as when learning through multimedia, rather than one, because the learner creates more cognitive paths that can be followed to retrieve the information (Mayer & Anderson, 1991; Paivio, 1967, 1991).

Overview of Computer-Mediated Software

A basic premise of computer-mediated instruction is that the student is at the center of the teaching-learning enterprise. The software must thoroughly present and explain the concepts and skills, pose items for students to solve to check their understanding, provide detailed feedback to guide students' learning, and allow students to control the navigation path and the pace of instruction. Further, the software should utilize the capabilities of interactive multimedia to the extent possible and not simply move material from the printed page to the computer screen. At the General College we have used *Interactive Mathematics* from Academic Systems Corporation (2001) since 2000.

Each lesson in the *Interactive Mathematics* software contains six sections, and each section is identified by an icon on the computer screen.

1. Overview: The Overview section provides a preview to the lesson and includes an optional pretest. Students who obtain a high score on the pretest may only need to review the content in the lesson rather than studying the lesson in its entirety. Based on the pretest score, the software makes a recommendation for what the student should study.

2. Explain: This section is the primary source of instruction. It uses text, animation, graphics, video, and voice to provide a thorough presentation of the concepts and skills for each lesson. Items are embedded in the instruction to check students' understanding as they progress through the software. Students who correctly answer a question on the first attempt are informed that they are correct, and the solution is displayed in detail with an explanation

of the steps. Students who do not answer correctly on the first attempt are given a hint and allowed to attempt the item a second time. After the second attempt students are informed if they are correct, and the complete solution is displayed.

3. Apply: The Apply section contains a set of problems representative of those introduced in the Explain section. Students who are uncertain how to answer an item can click on an icon that links back to the relevant part of the Explain section. Once they have reviewed the content from the Explain section, they can link back to the Apply section and proceed. Students are provided with the complete solution after answering each item.

4. Explore: This section contains activities that extend the concepts and skills beyond the level covered in the Explain section. Many of the Explore activities involve applications and problem-solving activities and can be used for group activities.

5. Evaluate: The Evaluate section provides online quizzes. Students receive detailed feedback once they finish an Evaluate. The instructor has the option to allow students one, two, or three attempts on each Evaluate quiz. The course management system records each attempt by a student and displays the student's highest score in a summary report.

6. Homework: This section provides a suggested list of Homework problems for students to work based on their performance in the Explain and Apply sections. Some institutions do not assign homework but recommend to students that they work the problems assigned by the software. At the General College we assign specific homework problems for each lesson to all students. A convenient feature of the software is that it contains the entire textbook on a pdf file. This allows students access to the homework problems in class without having to carry the book to school.

The management system provides two types of reports. An individual report for each student includes the time spent on each section of the software and performance outcomes on the items in each section. A section report provides a summary of the scores for each class on the Evaluates and the total time each student has used the software. The information in these reports is useful for monitoring students' progress so that the instructor can intervene in a timely manner to assist the student in improving outcomes. The intervention may consist of working more closely with the student while in class, discussing strategies for learning mathematics more effectively, arranging to work with a tutor, and involving the student's advisor when appropriate.

Structure of Computer-Mediated Courses

When we designed the computer-mediated courses, we decided to draw upon the features of the lecture courses that promote attendance, provide students with feedback, and facilitate keeping students on track. We designed our computer-mediated courses so that they have a high degree of structure, including the expectation that students attend each class meeting, as opposed to something much less structured, such as a self-paced course in an open lab. This was done even though the *Interactive Mathematics* software can be used by students in their residence hall rooms and at home provided they have Internet access.

In the computer-mediated and lecture classes all students are expected to attend every class meeting. Classes are scheduled for 50 minutes per meeting for 4 days a week, or 100 minutes per meeting for 2 days a week. All students are given a schedule at the beginning of the semester that lists the material to be covered each class meeting and the problems that are to be worked using paper and pencil and turned in for grading. All students take paper and pencil quizzes and exams according to a set schedule. Class size in both computer-mediated and lecture classes is typically limited to 35 students.

Next, we discuss the computer-mediated courses in greater detail. The course structure we developed was primarily for traditional students who were able to attend regularly scheduled classes. The course structure for a different group of learners, such as those in a distance education class, may include some of the components of our course structure but certainly not all of them.

Daily Schedule of Class Activities

Students are given a schedule at the beginning of the semester that outlines the events for each class period during the semester. The schedule includes: (a) the lessons students are to study each day, (b) assignments to be turned in for grading and their due dates, (c) daily checkpoint dates, (d) exam dates, and (e) quiz dates. A set schedule informs students of the pace that they must progress through the course to complete it by the end of the semester. It also establishes a guideline for students and instructors to determine if a student is on track or behind. If a student is behind schedule, the instructor may talk with the student about his or her progress and develop with the student a plan for getting back on schedule. If the instructor thinks that intervention by the student's advisor may be helpful, the instructor will send an academic alert to both the student and the advisor.

Homework Assignments

Students are assigned problems to be worked using paper and pencil for each lesson. These are turned in for grading on a set schedule and usually returned to students the following class period. The homework is graded and recorded by an undergraduate teaching assistant who is present with the instructor during each class period. Collecting homework provides a mechanism for instructors to identify students who are not on track and need assistance. Because a computer-mediated course instructor does not lecture, it is critical that instructors find mechanisms to monitor students' progress closely. Collecting homework is one such mechanism. In focus groups (Kinney, 2000), 31 out of 32 students recommended that we continue to collect and grade homework. Students explained this by saying that it kept them on track, helped them learn the math, and that if it was not required, they would work a lot fewer problems and not be as prepared for exams. When assigning homework we take the approach that the amount of homework we ask students to do should be reasonable; that the due dates should be given well in advance; that students can receive assistance from classmates, the instructor, or in the Mathematics Center; and that quiz and exam items should be closely aligned with the assigned homework.

Exams and Quizzes

The exams are given to students on paper rather than on the computer. Students may use a calculator on the exams and quizzes. Five exams are given per semester plus a comprehensive final exam. By giving a fairly large number of exams, students are able to study smaller chunks of the course for each exam. This is especially helpful for students who struggle with math. Six quizzes are also given during the semester according to a set schedule, and students are informed about the contents of the quizzes. Students complete the quizzes individually using paper and pencil.

Checkpoint Questions

Checkpoint questions consist of one or two questions over recently covered concepts or skills. They are given to students typically early in the class period and are due by the end of class. Students are encouraged to work together, compare strategies, and determine if their solutions make sense. Students may use any available resource. When students believe that they have answered the question correctly and have provided a sufficient written explanation of how they arrived at the answer, the instructor checks their work. If it is correct and complete, the instructor informs the student of this and collects it so that the score can be recorded. If a student is having difficulty, the instructor provides feedback to point the student in the right direction. The checkpoint questions count for a small part of students' grades, and because they can only be taken during the scheduled class meeting, they promote good attendance.

Checkpoint questions also promote student-student interaction, which makes a computer-mediated course feel more like a regular class rather than an open lab. In addition, checkpoint questions help instructional staff identify students who do not yet understand recently covered concepts or skills, which opens the door for the instructor to work with students in need of assistance. This can be important because students do not always ask questions when they should, in part because they are not always aware of things that they do not yet know. The checkpoint questions also promote student-instructor contact. This is important to establish early in the semester so that students and instructors establish good communication. In the focus groups, when students were asked if we should use checkpoint questions again, 30 students indicated "yes," and 2 marked "no."

Evaluates

The Evaluates are online quizzes. The software provides three parallel forms for each lesson. Students' scores are recorded in the management system. In our initial implementation of computer-mediated learning we included the Evaluates, but later we discontinued them and now use the checkpoint questions instead. Many of the students still complete the Evaluates because they provide students with feedback about their understanding of the mathematics. Although many colleges use the Evaluates, we discontinued using them in part to save time and in part because the checkpoint questions generate more student-teacher interaction.

Role of the Instructor in a Computer-Mediated Class

In a computer-mediated class the student is at the center of the teaching and learning enterprise, not the instructor. The role of the instructor, therefore, does not include presenting the material. Instructors may be responsible for selecting the software, ensuring that the computer lab is functional, developing a course structure that is effective for their students, and completing other duties that instructors typically incur when teaching a lecture course.

During the computer-mediated classes the instructor continually moves about the classroom, stopping to assist students as requested and when the instructor senses that a student can use assistance. We found that it is important that the instructor be available to students throughout the class period. Being available to our students in a meaningful way means that the instructors move about the room so that they are within an arm's reach of each student on a regular basis. This means that instructors do not engage in any administrative tasks that can be completed outside of class, conversations not related to teaching the class, or other activities that communicate to students that the instructor is not available to work with students. When an instructor appears to be disengaged from working with students, students are less likely to attempt to engage the instructor. In computer-mediated classes instructors sometimes take the view that they are not "teaching" because they do not present the content. Students, however, still tend to view the instructor as the "teacher" and therefore believe the instructor should be focused on students' learning and should always be available to assist them.

The instructor typically views or prints the data from the course management system just prior to the start of class to be aware of which students are behind schedule or are having difficulty in certain areas. This information better enables the instructor to intervene early when a student is having difficulty. We have found that students often do not ask questions as soon as they should or that they do not ask a question until the instructor initiates the discussion.

Student Performance in Computer-Mediated and Lecture Classes

We compared the performance of students in the computer-mediated and lecture courses using both quantitative and qualitative measures (Kinney, 2001). Data were gathered on a total of 668 students, most of whom were incoming freshmen while the rest were predominantly sophomores. An inventory was administered on the first day of class that included items related to students' past experiences learning mathematics, learning styles, and attitudes towards mathematics and computers. A second inventory was administered just prior to the final exam that contained items related to course satisfaction in addition to the same items that were administered at the start of the semester. Student focus groups were conducted with computer-mediated courses during the last week of class to gather information related to their learning experiences using interactive multimedia software and their attitudes toward computer-mediated instruction.

The Mathematics Placement Exam

The mathematics placement exam scores were obtained from the university database for the 462 incoming freshman participants to examine potential differences in the mathematics background of students at the start of the semester. The math placement exam contained 41 items that were representative of the items covered in the courses. In the Introductory Algebra classes, the math placement test data revealed no significant differences for students enrolled in the computer-mediated ($M = 12.3$, $SD = 3.1$) and lecture classes ($M = 11.4$, $SD = 3.5$), $t(219) = 1.76$, $p = .08$. Also, in the Intermediate Algebra classes there was no significant difference in the computer-mediated ($M = 20.4$, $SD = 4.9$) and lecture classes ($M = 20.4$, $SD = 5.2$), $t(246) = .150$, $p = .88$ on the math placement exam (Kinney, 2001).

Common Final Exams

Students in the computer-mediated and lecture sections of each course were administered the same final exam. Because different instructional materials and midterm exams were used in the computer-mediated and lecture classes, instructors who taught in each format reviewed the items on the final exam to ensure they were thoroughly covered. There was no significant difference (Kinney, 2001) on the final exams in Introductory Algebra computer-mediated ($M = 70.12$, $SD = 14.57$) and lecture classes ($M = 70.82$, $SD = 16.61$), $t(233) = .30$, $p = .76$, or in the Intermediate Algebra computer-mediated ($M = 67.19$, $SD = 12.26$) and lecture classes ($M = 68.47$, $SD = 11.61$), $t(336) = 1.02$, $p = .31$.

Pass Rates

The pass rates revealed no significant differences (Kinney, 2001). In Introductory Algebra, 81% of the computer-mediated and 78% of the lecture students passed with a grade of D or higher, χ^2 (1, $N = 235$) = .24, $p = .63$. In Intermediate Algebra, 88% of the computer-mediated and 90% of the lecture students passed the course with a grade of D or higher, χ^2 (1, $N = 338$) = .58, $p = .45$. The pass rate data excluded students who had officially withdrawn or received incompletes.

The lack of a significant difference on the final exams was not surprising. Students, whether in a computer-mediated or lecture class, must learn essentially the same content. In general, this process involves viewing a presentation of the material, asking questions as needed, and working a sufficient number of problems to develop the necessary mathematical understanding. The purpose in offering both computer-mediated and lecture classes was to provide students with a choice about how they learned mathematics. Therefore, the lack of a significant difference on the final exam scores supports the view that students can learn effectively in both instructional formats. It is worth noting that nearly all students were able to self-select into the instructional format of their choice.

Proportion of Withdrawals

In Introductory Algebra, we (Kinney, 2001) found the proportion of withdrawals from computer-mediated classes was .04 (N = 76) while the proportion of withdrawals from lecture classes was .09 (N = 206). In Intermediate

Algebra, the proportion of withdrawals from computer-mediated classes was .01 (N = 134) while the proportion of withdrawals from lecture classes was .07 (N = 252). The values of N represent the number of students enrolled at the end of the second week of classes because students can withdraw from a class during the first two weeks of the semester with no record on their transcript (Kinney). Students in lecture courses were significantly more likely to withdraw than students in computer-mediated courses according to a chi-square test, χ^2 (1, N = 210) = 7.5, $p < .01$. Data from the previous year found that an almost identical proportion (.07) of students withdrew from both computer-mediated and lecture classes. Two possible explanations for the lower proportion of students withdrawing from computer-mediated classes in the second year are improved procedures for informing students of the nature of computer-mediated instruction and changes in the computer-mediated course structure that promoted better attendance and timely completion of assignments.

Attendance

There was no significant difference (Kinney, 2001) according to t-tests in the attendance patterns between students in computer-mediated and lecture classes for each course when excluding students who had withdrawn. In Introductory Algebra, computer-mediated students attended 75.4% of classes while lecture students attended 76.4%, $t(258) = .395$, $p = .693$. In Intermediate Algebra, computer-mediated students attended 78.9% of classes while lecture students attended 81.2%, $t(361) = 1.29$, $p = .199$.

Survey Items

We obtained feedback from students through an end-of-the-semester survey and through focus groups (Kinney, 2001). The end-of-the-semester survey included the following six items related to course satisfaction, with students responding: 1 = Disagree, 2 = More disagree than agree, 3 = More agree than disagree, and 4 = Agree.

1. Overall, I enjoyed this math class.
2. This course was designed in a way that helped me learn mathematics.
3. This course has prepared me for future math courses.
4. Most of the math that I learned this semester I learned while in class.
5. The materials for this class, book and/or software, were helpful in learning the math.
6. I was satisfied with the instruction in this class.

The results, shown in Table 1, indicate that the Introductory Algebra students in computer-mediated classes were significantly more satisfied than students in lecture classes, $t(229) = 3.29$, $p = .001$. Similarly, Intermediate

TABLE 1
Course Satisfaction

Course	*N*	Mean	*SD*	*SEM*
Introductory Algebra				
Computer-mediated	65	3.52	.48	.06
Lecture	166	3.23	.63	.05
Intermediate Algebra				
Computer-mediated	120	3.51	.46	.04
Lecture	216	3.33	.48	.03

TABLE 2
Activities that Contributed to Learning Mathematics

	Computer-mediated		Lecture	
Activity	*N*	%	*N*	%
Software/lecture	101	69.7	158	36.3
Doing homework	39	26.9	227	52.2
Using the math center	1	0.7	31	7.1
Reviewing for exams	4	4.4	19	4.4

Note. Software/lecture refers to "using software" for computer-mediated classes and "listening to lectures" for lecture classes.

Algebra students in computer-mediated classes were significantly more satisfied than students in lecture classes, $t(334) = 3.39$, $p = .001$.

The end-of-the-semester survey also asked students about their perceptions of the activities that contributed most to their learning. Computer-mediated students were asked the following question: Which of the following activities resulted in your learning the most mathematics? Students selected from the following choices: (a) using software, (b) doing homework, (c) using the math center, and (d) reviewing for exams. For students in lecture classes, the first choice was changed to "listening to lectures."

The choices "using software" and "listening to lecture" are the primary methods of delivering the instruction in the computer-mediated and lecture formats, respectively. The results, shown in Table 2, indicated significant differences in the activities that contributed most to student learning according to a chi-square test, χ^2 $(3, N = 580) = 51.1$, $p < .001$. Computer-mediated students indicated that using the software was the primary activity that resulted in learning mathematics, whereas lecture students learned mathematics primarily by doing homework.

It is interesting to note that 69.7% of the students in the computer-mediated classes indicated that they learned the most mathematics through their primary mode of instruction, which is the software. In contrast, only 36.3% of the students in lecture classes indicated that they learned the most mathematics through their primary mode of instruction, lecture. One explanation for this difference is that the software, through its use of multimedia, interactivity, and feedback, was simply more effective than lecture. Another explanation is that the software provided more opportunities for students to work problems actively in class than were provided to students in lecture classes. Thus, the computer-mediated instruction may have provided students with an opportunity to learn the content but also to work a substantial number of problems like those that are in the homework.

Next, we asked students about their confidence to succeed in math with the following item. During this semester my confidence to succeed in mathematics has: 1 = Decreased a lot, 2 = Decreased slightly, 3 = Not changed, 4 = Increased slightly, and 5 = Increased a lot. The responses from computer-mediated students ($M = 3.89$, $SD = .97$) were significantly higher, but just slightly, than those of students in the lecture classes ($M = 3.72$, $SD = .89$), $t(595) = 1.996$, $p = .046$. What was important, in our view, is that students in both formats tended to report an increase in their confidence to succeed in mathematics.

Finally, we examined students' attitudes toward mathematics with this item. During this semester my attitude towards mathematics has gotten: 1 = Much worse, 2 = slightly worse, 3 = not changed, 4 = slightly better, and 5 = much better. Students in both the computer-mediated and lecture classes reported an improved attitude towards mathematics. The responses from computer-mediated ($M = 3.71$, $SD = .95$) and lecture classes ($M = 3.72$, $SD = .88$), $t(598) = .12$, $p = .90$, showed no significant difference.

Focus Groups

Five focus groups were conducted during the last week of class with a total of 30 students from the computer-mediated classes (Kinney, 2001). Students completed a written set of questions prior to attending the focus groups. These questions served as a basis for discussion during the focus groups. Among the items discussed were the Explain and Apply sections of the software.

The Explain section introduces and explains the concepts and skills using interactive multimedia. When students were asked, "Overall, how good was the software at explaining the mathematics?" all but one student responded positively. Features that students valued were multimedia explanations that helped them understand the concepts and skills, control the pace as they navigated through the software, and get opportunities for practice and feedback within the instruction. Students who wanted more time to process the material or to take notes found being able to control the pace and being able to go back to previous instruction particularly valuable.

The Apply section contains a set of practice items that are typical of the skills and concepts covered in the Explain section. Students receive detailed feedback as they complete each item. When students were asked, "Overall, how helpful was working the Apply problems in learning how to do problems for each section?" all but two students responded positively. Several students said that they understood the material fairly well before attempting the Apply section, and therefore they did not benefit very much from working the Apply problems. Students had the option of not working the Apply problems, but most students worked them because they found the practice and feedback helpful. Also, students liked being able to practice a set of problems immediately after completing the Explain section.

Students were also asked if they thought they understood the mathematics better in a computer-mediated class than they would have in a lecture class. All 30 students who responded indicated "yes." This result was due in part to satisfaction with the software and how the computer-mediated classes were structured, but it was also due in part to considerable dissatisfaction with their experiences in high school mathematics classes. Students indicated that they enrolled in the computer-mediated classes primarily to avoid enrolling in a lecture class because of negative experiences in high school lecture classes and because they wanted more control over their learning. All participants indicated that they thought they had more control over their learning in a computer-mediated class than they would have had in a lecture class. Students also strongly recommended that we continue to assign, collect, and grade homework according to a set schedule, and give daily checkpoint questions because these encourage students to stay on task and provide feedback.

Trends in Computer-Mediated Mathematics Instruction

Technology has led to the development of new models for delivering developmental mathematics instruction. Students today have more choices in terms of where, when, and how they study mathematics. Although software is an important part of these new models, the instructor remains a vital component. The instructor must still organize the course, provide feedback to students, assess their learning, answer individual questions, and often handle technical issues.

Before examining details about various models for delivering developmental mathematics instruction using software, we will discuss two basic types of software that are used in these courses, "bolt-on" software and mediated learning software. Bolt-on software is software that was developed by publishers by combining resources that were originally designed to support students in a traditional lecture class. These resources include: (a) software for generating problems algorithmically, (b) videotapes of a teacher presenting each lesson, and (3) the textbook. These resources are typically "bolted on to" a traditional course, but do not fundamentally change how the instructor teaches or how students learn. That is, the instructor still lectures, and students take notes and ask a few clarifying questions.

The process of combining existing resources does not necessarily result in software that effectively incorporates interactive multimedia to provide complete and detailed presentations of concepts and skills or other attributes that support computer-mediated learning. This is because these resources were designed to support traditional lecture classes rather than to support mediated learning as described by Gifford (1996). Software developed from bolt-on resources is often best suited for an instructional model that includes the instructor presenting or reviewing the content during at least part of the instructional class.

Computer-mediated software, in contrast to bolt-on software, is designed from the ground up to support mediated learning as defined by Gifford (1996). In mediated learning, the student is at the center of the teaching and learning enterprise rather than the instructor. The implication for software selection is that the software must be capable of replacing the instructor as the primary vehicle for delivering the instruction. That is, the software must provide a thorough presentation of the concepts and skills, pose items for students to solve to check their understanding, and provide detailed feedback to guide students' learning. Further, the components of the lessons should be organized in a logical manner so that the navigation path is easy for students to follow. To perform these functions effectively, the software should utilize the capabilities of interactive multimedia to the extent possible and not simply move material from the printed page to the computer screen.

Instructional Models

When developing an instructional model that involves technology, it is worth considering two suggestions made by Johnstone (2002). First, the thinking and planning must start from the student's perspective. Second, plan a project that solves a problem, not one that just brings more resources into the institution. Many developmental mathematics classes taught using a form of alternative delivery, such as distance education, now use interactive multimedia software such as *Interactive Mathematics* from Academic Systems Corporation (2001) as the primary source of instruction.

There are two primary reasons for incorporating software in a course taught using an alternative delivery such as an online course. First, it is difficult for an instructor to present the content online in a manner that is effective and efficient. Because the software is capable of providing a comprehensive presentation of the content through interactive multimedia, the instructor is able to focus on answering students' questions rather than on presenting the content. The second reason for incorporating software is that it allows the students to study anywhere, anytime. This is particularly important for students whose work and family obligations make it difficult to attend regularly scheduled class meetings. It is also interesting to note that students studying mathematics perform significantly better when they are able to learn at the time of day that best suits their preferences (Callan, 1999). Callan found that the scores of students who took math tests in the morning were significantly higher than those of students who took tests in the afternoon. The most commonly used instructional models that involve technology in developmental mathematics are shown in Figure 1.

Direct instruction. We briefly consider direct instruction because it provides a frame of reference for the other instructional models. In this model the teacher and students are in the same location, and students receive instruction at the same time during the day. The instruction is synchronous because students study the same mathematics at the same moment in time because the instruction is teacher-centered. The presentation of the content is linear because in a teacher-centered classroom the instructor determines the order of the presentation of the content. Technology, other than calculators, is typically not used. Most publishers, however, include a technology component with the textbook such as a CD or a Web site. These resources may include a review of concepts and unlimited practice with skills using algorithmically-generated questions, digital videos of each lesson, and online tutorial help from a tutoring center.

Hybrid instruction. There are two basic implementations of this model. Both implementations include teacher-directed instruction for part of the class and students using software during the remaining part of class.

1. Software presents the content. In this model software that supports computer-mediated instruction presents the content through interactive multimedia during part of the in-class instructional time. For example, students may use the software 2 days per week while a third day involves teacher-directed instruction. When students use the software, they typically learn asynchronously. That is, they are learning the same content at different moments in time even though they are using the software during the same class period. The presentation of the content may be nonlinear because students are able to navigate through the software along the path of their choice.

Instruction Model	Characteristics of Each Model A. Location of teacher and student. B. Time of day when learning occurs for students in a class. C. Synchronous or asynchronous learning for students in a class. D. Teacher-centered or student-centered instruction. E. Linear or nonlinear instructional materials				
	A	B	C	D	E
1. Direct instruction	Same	Same	Synchronous	Teacher-centered	Linear
2. Hybrid instruction i. part using direct instruction	Same	Same	Synchronous	Teacher-centered	Linear
ii. part using software	Same	Same	Asynchronous	Student-centered	Nonlinear
3. Open labs supported by instructional staff	Same	Different	Asynchronous	Student-centered	Nonlinear
4. Mediated learning	Same	Same	Asynchronous	Student-centered	Nonlinear
5. Interactive television	Different	Same	Synchronous	Teacher-centered	Linear
6. Distance learning incorporating software	Different	Different	Asynchronous	Student-centered	Nonlinear

Figure 1. Instructional models in developmental mathematics.

One student, for example, may take a pretest first, while a second student may begin by studying the content in the lesson. During the time that students are using the software, the instructor is available to assist students individually or in small groups. The second component of this implementation involves teacher-directed instruction. Here the instructor may lead a whole-class discussion to address any questions that students have on the concepts or skills in the lesson. This time may also be used to have students work in groups, supplement the content in the software, or administer quizzes and exams.

2. Instructor presents the content. In this implementation the instructor presents the content. After the instructor provides an overview of the content, students use the software to develop skills and review the main concepts. This implementation provides students with the benefits of direct instruction for the presentation of the content, yet allows students greater flexibility in the

development of skills than may be possible in a traditional classroom. The software used in this model should allow students to quickly identify the skills or concepts that they are interested in studying and to access them easily.

Open labs supported by instructional staff. In this model students make use of an open lab supported by instructional staff at the times that fit their schedules. Software that supports mediated learning is appropriate for this model because students learn independently most of the time. The lab may also be used for administering quizzes and exams. Even though students have a great deal of flexibility in when and where they learn in this model, it is important that students understand the course expectations and that they are able to receive frequent feedback about their progress. Students who study mathematics through an open lab should have good study and time management skills. The open lab model is a convenient model to structure with a mastery-based approach consistent with Keller's (1968) instructional model called the personalized system of instruction.

Computer-mediated learning. Because computer-mediated instruction was discussed in depth earlier, we briefly mention several points here. First, computer-mediated instruction and lecture instruction differ on several important characteristics. The instruction in a lecture class is teacher-centered, synchronous, and linear, whereas instruction in a computer-mediated class is student-centered, asynchronous, and nonlinear. Clearly, a computer-mediated class requires that students take control of their own learning.

Second, in both computer-mediated classes and in open labs the instruction is student-centered, asynchronous, and nonlinear. Students in a computer-mediated class meet at the same time and with the same instructor, whereas students in an open lab typically meet at different times and may work with several different instructors. For developmental education students, the benefit of computer-mediated instruction is that they are able to work closely with a single instructor and with classmates during each class meeting. Further, computer-mediated classes are typically more highly structured than open labs. This can contribute to students remaining on schedule and to instructors providing more timely feedback regarding progress in the course.

Interactive television (ITV). In this model students are located either in the same classroom as the instructor or at a remote location connected through interactive television (ITV). Television cameras and microphones at each site allow the instructor and students to communicate in real time. Instruction may be supported by a projection unit that projects what the instructor writes on paper to each site, a mimeo whiteboard that captures the images the instructor writes on a whiteboard, or a computer connected to the ITV system. Hodge-Hardin (1997) conducted a study to determine if there were differences in the math achievement of students taught in an ITV class setting with the instructor present (i.e., host site), students receiving instruction via television at an off-campus location (remote site), and students taught in a traditional classroom setting. The results showed no significant differences in math achievement among the three groups, and students in both television settings had positive attitudes toward future ITV course participation.

ITV allows students to learn from various locations, yet interact with their instructor and classmates in real time. The ITV sessions may be recorded and broadcast again at a later time or reviewed by students after class. Software may effectively support an ITV class by providing students with additional instruction and practice outside of class, which may be important in part because students at a remote site may not be able to attend the instructor's office hours.

Distance learning incorporating software. Distance education courses that incorporate appropriate software can effectively meet the needs of students who desire flexibility in where and when they study mathematics. Software that supports computer-mediated learning such as *Interactive Mathematics* from Academic Systems (2001) is often incorporated because it provides a thorough presentation of the concepts and skills using interactive multimedia, detailed feedback for students' responses, and online quizzes. Also, distance education instructors often develop their own Web site to support their courses or include a Web platform such as Blackboard or WebCT to facilitate communication between students and the instructor. Many of the students who enroll in distance education courses are full-time students at the same institution that offers the distance education course. This is due in part to the flexibility that distance education offers in terms of time and location.

When designing a distance education course for developmental education students we believe it is important that the instructor: (a) selects software that supports students learning independently, (b) develops a course structure that provides flexibility yet promotes students completing the course on schedule, and (c) provides students with individual feedback and assistance as necessary. The instructor's role typically does not include presenting the content because the software is the primary vehicle for delivering the content. Not all students, however, are good candidates for distance education courses. Carr (2000) found that distance education courses often have lower completion and retention rates than classes that meet face-to-face. To assist students in determining if they are likely to have a successful experience studying through distance education, many institutions have developed questionnaires that students can complete before enrolling in a distance education course. For example, the Western Governor's University, an online institution that offers online degrees, developed an online questionnaire that provides students with immediate feedback regarding their fit for a distance education course (Western Governors University, n.d.). The questionnaire is available at http://www.wgu.edu/admissions/requirements.asp and can be accessed through the link, "Is online study for you?"

Future Directions in Computer-Mediated Learning

In the previous section we discussed a variety of instructional models that are currently used to offer developmental mathematics courses. However, software is increasingly being used in other areas too, such as: (a) technical mathematics courses; (b) preparation for the General Education Diploma (GED); (c) support for courses such as chemistry, physics, and business; and (d) workforce training.

In a technical mathematics course students study the concepts and skills of arithmetic and algebra, but they also are required to apply the mathematics to technical applications. Software such as *Academic.com* from Academic Systems (2000), which provides a brief review of the skills and concepts using interactive multimedia, can be used to support the instruction of the concepts and skills. The instructor can then focus on teaching the technical applications. Preparation for the GED, which often involves students studying independently much of the time, can be supported by software to provide a review of the relevant concepts and skills. Students who study independently often find that the interactivity of software, unlike print materials alone, helps to keep them engaged when studying.

Another area where software is increasingly being used is for support in courses that use mathematics, such as chemistry, physics, and business. Because many students enter these courses with inadequate backgrounds in mathematics, instructors are increasingly looking for ways to address this issue. In the past most instructors of these courses devoted at least some time to teaching or reviewing the necessary mathematics as it was needed. Today, however, departments or even entire colleges are providing students with access to software such as *Academic.com*, which is Web-based, so that students can review the necessary mathematics outside of class prior to the time that it is used in class. This frees up the instructor from having to cover the mathematics, but it also makes it possible for students to acquire the necessary mathematics background without having to enroll in a developmental mathematics course.

Finally, institutions or companies that provide workforce training make extensive use of software because it is a cost-effective and flexible solution. In many cases software is used to provide the fundamentals of the concepts and skills, and applications are added that are tailored to the company's specific needs.

Summary

Through our research on computer-mediated instruction we sought to understand students' learning experiences in computer-mediated classes designed for developmental education students. Our research provides evidence that for some students, computer-mediated instruction is a viable alternative to lecture, both in terms of supporting students' preferred learning styles and in effectively learning the mathematics. As technology continues to evolve, developmental educators will continue to be given both the opportunity and the challenge of developing more effective developmental education courses.

References

Academic Systems. (2000). *Academic.com* [computer software]. Bloomington, MN: Plato Learning.

Academic Systems. (2001). *Interactive mathematics* [computer software]. Bloomington, MN: Plato Learning.

Bagui, S. (1998). Reasons for increased learning using multimedia. *Journal of Educational Multimedia and Hypermedia, 7*(1), 3–18.

Becker, H. J. (1992). Computer-based integrated learning systems in the elementary and middle schools: A critical review and synthesis of evaluation reports. *Journal of Educational Computing Research, 8,* 1–41.

Bosco, J. (1986). An analysis of evaluations of interactive video. *Educational Technology, 25*, 7–16.

Callan, R. (1999). Effects of matching and mismatching students' time-of-day preferences. *The Journal of Educational Research, 92*, 295–299.

Carr, S. (2000). As distance education comes of age, the challenge is keeping the students. *Chronicle of Higher Education,* 46(23), A39–A41.

Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review,* 37, 250–263.

Fletcher, D. (1989). The effectiveness and cost of interactive videodisc instruction. *Machine-Mediated Learning, 3,* 361–385.

Fletcher, D. (1990). *The effectiveness and cost of interactive videodisc instruction in defense training and education* (IDA Paper P-2372). Alexandria, VA: Institute for Defense Analyses.

Gifford, B. R. (1996). *Mediated learning: A new model of technology-mediated instruction and learning.* Mountain View, CA: Academic Systems.

Hodge-Hardin, S. (1997). *Interactive television versus a traditional classroom setting: A comparison of student math achievement*. Retrieved January 11, 2005, from http://www.mtsu.edu/~itconf/proceed97/hardin.html

Johnstone, S. M. (2002). Can distance-learning planners share? *Syllabus, 16*(5), 27.

Khalili, A., & Shashaani, L. (1994). The effectiveness of computer applications: A meta-analysis. *Journal of Research on Computing in Education, 27*, 48–61.

Kinney, D. P. (2001). A comparison of computer-mediated and lecture classes in developmental mathematics. *Research & Teaching in Developmental Education, 18*(1), 32–40.

Kulik, C., & Kulik, J. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior, 7,* 75–94.

Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology, 83,* 484–490.

Najjar, L. J. (1996). Multimedia information and learning. *Journal of Educational Multimedia and Hypermedia, 5*(2), 129–150.

Niemiec, R., Samson, G., Weinstein, T., & Walberg, H. (1987). The effects of computer-based instruction in elementary schools: A qualitative synthesis. *Journal of Research on Computing in Education, 20*, 85–103.

Paivio, A. (1967). Paired-associate learning and free recall of nouns as a function of concreteness, specificity, imagery, and meaningfulness. *Psychological Reports, 20,* 239–245.

Paivio, A. (1991). *Imagery and verbal processes.* New York: Holt, Rinehart, & Winston.

Verano, M. (1987). *Achievement and retention of Spanish presented via videodisc in linear, segmented and interactive modes.* Unpublished doctoral dissertation, University of Texas, Austin, TX.

Western Governors University survey. (n.d.). Retrieved January 15, 2005, from http://www.wgu.edu/admissions/requirements.asp

CHAPTER 16

Integrating and Enabling Skill Development in a Symbolic Logic Class

Carl J. Chung

ABSTRACT

This chapter illustrates an approach to teaching students considered at risk that integrates skill acquisition and development along with regular college-level course content. Using an introductory symbolic logic course as the focal point, I distinguish three different layers of skills: content skills, general academic skills, and affective skills. By detailing specific teaching techniques from the logic course, I show how an integrated skills and content approach avoids shortcomings and questionable assumptions associated with a more traditional approach, which offers stand-alone courses in basic reading, writing, and mathematics.

A compelling case can be made that developmental education is, essentially, about helping students acquire and hone basic academic skills. For example, this includes being able to read college-level material and demonstrate understanding; being able to take notes from text or lecture; being able to write prose that is clear, effective, and meets the requirements of a given assignment; being able to engage the world of mathematics through symbol manipulation, quantitative reasoning, and translation from English to mathematical expressions and back again; and, finally, being able to manage one's time in the face of multiple commitments, including school, family, work, and friends. These examples are "skills" in the sense that they require an individual to be able to *do* something. They are "academic" in the sense that college success requires proficiency in such skills, though not exclusively so. They are also "basic" in the sense that most mainstream college students have skill sets that encompass them, while students considered at risk, for a variety of different reasons, do not.

Traditionally, developmental educators and learning assistance professionals have met the needs of students considered at risk by offering stand-alone courses in study skills, basic reading, basic writing, and basic mathematics

(Casazza & Silverman, 1996; Maxwell, 1997). More recently, stand-alone "learning-to-learn" courses have been implemented that attempt to teach higher-order thinking and self-regulation to students considered at risk (Simpson, Hynd, Nist, & Burrell, 1997). Alternatives to stand-alone course offerings have also been developed, including Supplemental Instruction, paired courses, summer bridge programs, self-paced learning labs, and learning assistance centers (Simpson et al.). Yet the growing list of alternative options for delivering help to students considered at risk has not rendered the stand-alone course model obsolete. For example, Perin (2002) summarized 1996 National Center for Education Statistics data documenting that more than 50% of community colleges offer stand-alone developmental education courses in reading, writing, and mathematics through regular academic departments. As Perin observed, "developmental education courses are the most visible form of remediation in community colleges" (p. 27).

When such stand-alone courses are required and carry no graduation credit, critics have argued that the à la carte approach is neither successful nor cost effective (Maxwell, 1997). Although particular historical contexts, institutional climates, and financial support for such programs need to be borne in mind, two main problems stand out. First, students often feel stigmatized when required to take such courses (Pedelty, 2001), which in turn leads to lower motivation and self-esteem. Second, those students needing the most help are often relegated to a whole series of such courses, thereby making little or no progress toward their long-term educational goals (Boylan & Saxon, 1998).

Another way to express the shortcomings of the stand-alone course model is to consider how it is consistent with a set of questionable assumptions, or at least assumptions that we, as developmental educators and learning assistance professionals, are moving beyond. First, the stand-alone model is consistent with a stage or hierarchical conception of skills. In other words, there are basic, regular, and advanced skills required to succeed in college, and students need the basic skills in order to acquire the regular and advanced skills. Therefore, students considered at risk cannot even attempt mainstream college coursework until they have demonstrated that they have mastered the basic skills that are prerequisites for the more advanced skills. Intuitively this seems to make good sense, but as I illustrate later, skill acquisition and skill development are more dynamic processes that turn on student motivation and the meaningfulness of the context in which they are taught.

Second, the stand-alone model assumes that basic skills transfer readily to new contexts, so that once students have acquired basic reading, writing, and mathematical skills in their developmental courses, they carry these skills with them and successfully apply them when they move on to regular college coursework. But based on my own experience as an instructor, students considered at risk, especially those with learning disabilities, often start from scratch when they find themselves in a new learning environment. It may be that students know how to do X, and even believe that they ought to do X, but nonetheless they do not do X or are unable to do X in a new context.

Third, the stand-alone model appears to subscribe to a "one size fits all" approach to helping students acquire basic academic skills. In other words, it assumes that the same course in basic reading, writing, or math will be suitable for any at-risk student. But one of the defining changes facing developmental education continues to be the influx of new students with diverse backgrounds, such as immigrants, refugees, adults, and students with a whole range of learning, psychological, and other disabilities. Offering a set of standardized, stand-alone basic skills courses might work if the target population were reasonably homogeneous, but given the increasing diversity of students considered at risk and shortcomings of the stand-alone model, exploring more holistic alternatives seems worthwhile (Roueche & Roueche, 1999).

Whatever the perceived merits or shortcomings of stand-alone courses, alternatives to this traditional approach are being explored. As Martha Maxwell put it in her 1997 revision of the classic text, *Improving Student Learning Skills*,

> As students have become more diverse, courses have become more integrated. Now paired courses such as math/physics, math/chemistry, freshman English and biology, and developmental courses combining reading, writing, and sometimes mathematics skills are offered more frequently. Basic reading, writing, and mathematics are viewed as processes, not as separate courses. (p. iii)

In this quote, Maxwell pointed to the integration of traditionally isolated learning activities. My purpose in this chapter is to illustrate another sort of integration, the integration of basic skill development with regular freshman-level course content. In particular, I describe how I have integrated and enabled basic skill development in an Introductory Symbolic Logic class that is credit bearing and fulfills the University's "mathematical thinking" requirement. My main goals are to illustrate (a) how a developmental course can address basic skill development while at the same time teaching content and more advanced skills and (b) how creating a learning environment that enables skill acquisition and development is as important as teaching the skills themselves. In addition, I explore how such an integrated skills and content model is a step in the right direction as far as the shortcomings and problematic assumptions associated with the stand-alone model.

Given that few developmental education programs offer logic courses, however, I will begin with a brief discussion of the role and value of such a course in a developmental curriculum. Although it is not appropriate for every student, a symbolic logic course offers a number of advantages over more traditional developmental mathematics offerings.

The Role of a Logic Course in a Developmental Education Curriculum

Along with a course in statistics, introductory symbolic logic is offered in the General College (GC) curriculum as an alternative way for students to fulfill their mathematical thinking requirement. The course is particularly appealing to students who have not succeeded in other math courses such as algebra. Some students have had such negative experiences in high school math that they have come to believe they are "too stupid" to understand the material, while others have failed one or more university math courses and are desperate to get this requirement out of the way to complete their coursework and graduate. Based on my experience teaching the course, I believe there are two reasons why a logic course is a useful supplement to a more traditional set of developmental math courses. First, because the vast majority of students have not had any prior experience doing symbolic logic, it is easier for them to begin with a "clean slate." Second, symbolic logic sits at the intersection of language and mathematics, and thus I can appeal to students' knowledge of language to help ground the symbols and symbolic manipulations they need to learn. This helps students feel more comfortable with the material by providing an intuitive link between language, which is familiar to them, and logic, which is not.

Basic Skill Development in an Introductory Symbolic Logic Course

In this section, I begin with a brief overview of the logic course, including course structure, learning objectives, and why I think the course has been successful with "math phobic" (Tobias, 1978) students. Next, I delineate three different skill "layers" and connect different elements of the course overview to them. Finally, I present specific teaching techniques from the course and describe how each technique contributes to the acquisition of one or more of these skill types.

Overview of the Logic Course

The main goal of any introductory symbolic logic course is to teach students formal or symbolic techniques for evaluating the underlying logical form of arguments. Focusing on the underlying form is important because it is the form that may or may not be "valid." Valid forms are truth preserving, which means that any time true statements are entered into the form, that form

ARGUMENT	SYMBOLIZATION	PROOF	
Socrates is human.	Hs	(1) Hs	A
All humans are mortal.	(x)(Hx?Mx)	(2) (x)(Hx?Mx)	A
Therefore, Socrates is mortal.	|- Ms	(3) Hs?Ms	2 UO
		(4) Ms	3,1 ?Out

Figure 1. Sample argument

guarantees a new, true conclusion. To isolate an argument's form, students learn a variety of translation conventions that result in symbolic representations of the original language. To determine whether a form is valid, a number of different formal methods are employed. Figure 1 provides an example of an argument, its symbolization, and a proof of the form's validity.

The bulk of student time is spent learning terminology, translation conventions, and proof techniques. By the end of the semester, students learn to use approximately 10 logical symbols, 15 translation conventions, and 28 or so rules of inference to use in proof construction. In addition to reading the text, working through course packet handouts, and taking notes in class, students submit weekly homework assignments, complete five in-class mini quizzes, and take three in-class examinations.

As with other mathematics courses, students often communicate their skepticism about the usefulness of learning any of this material. To motivate students to understand the usefulness and value of learning logic, I tell students that the long-term benefits go beyond the specific details of what they learn in one semester. First, just by engaging in this sort of rigorous, deductive, and analytic thinking they will stretch their brains' abilities a bit further (i.e., logic as "aerobics for the brain"). As such, they will have concrete experiences to fall back on when they encounter other formal, symbolic systems. Second, being exposed to logical translation conventions and valid patterns of reasoning can help them to evaluate arguments they encounter in other contexts more carefully, detect fallacious reasoning, and evaluate and follow complex chains of reasoning. Finally, I tell them that after I made it through my logic course in graduate school I was subsequently able to pull out the logical structure of whatever I read more easily, which helped me to identify an author's main points and arguments for those points, and I was able to structure my own thinking and writing more logically, which helped me to write better papers and earn higher grades on essay exams. In this way, I try to convince students that there are *indirect* benefits to completing the course (Chung, 2004b).

Overall, the course works well for the majority of my students, in terms of the number of students who successfully complete the course and student feedback and perceptions in the form of student evaluations and comments. I attribute a large part of this success to broader affective issues. That is, the overarching goal of the course is to give students a positive math-type experience. I want them to experience success early and build up gradually to harder material so that they gain confidence in their abilities to translate and construct proofs. I also want them to use this positive experience to broaden their conception of what it is possible for them to accomplish, whatever their educational or vocational goals.

Three Skill Layers

Three distinct skill layers lie embedded in my course overview and are worth distinguishing. I will call them content skills, general academic skills, and affective skills.

1. Content skills are the nitty-gritty, discipline-specific abilities students need to master in order to do well in a given course. In the logic course, this includes being able to translate sentences from English into symbolic notation, construct proofs, and apply definitions of rules to new or tricky situations. Content skills are what students spend the bulk of their time learning and being evaluated on in their regular college coursework.

2. General academic skills cut across disciplines and tend to be less concrete than content skills. This skill layer is best thought of as a continuum running from basic to more advanced generalizable skills. In the logic course, I consider the following to be more advanced general academic skills: being able to evaluate arguments in a range of contexts, detect fallacious reasoning and follow complex chains of reasoning with the aid of symbolic representations, read more critically, and write more cogently. I consider these more advanced because not all students will make significant progress on them; they have their hands full learning content skills. Skills such as these also require more than a semester's worth of study to master; that is, they are lifelong skills or desirable "habits of mind" (Standards for Success, 2003). What about basic general academic skills? Here we need to distinguish between, on the one hand, more generic skills such as reading texts, writing coherently, note taking, test taking, study strategies, and time management; and, on the other hand, basic mathematical skills such as symbol manipulation, quantitative reasoning, and moving between English expressions and their mathematical representations. In the logic course, students experience and are exposed to all of these except for quantitative reasoning.

3. Affective skills sound odd at first, but here I have in mind students' willingness to become more confident in their mathematical abilities, to adopt a more positive concept of self, and to be open to broadening their conception of what it is possible for them to accomplish. By calling these "skills" I

mean to highlight the fact that students need to exert what is sometimes considerable, conscious effort to overcome low confidence, negative self-concept, and a diminished sense of possibility. Although instructors cannot do this for any given student, they can, nonetheless, create a learning environment in which affective skill development is more likely to occur.

This schema of skill layers is useful in several ways. First, it helps to clarify the difference between the stand-alone and integrated skills and content approaches further. Stand-alone courses focus on the basic end of the general academic skills continuum, and would thus usually tend to downplay content skills and affective skills, the latter being handled by another course or counseling staff, for example. The integrated approach, on the other hand, acknowledges that the classroom encompasses all three skill layers simultaneously and that learning one type of skill may promote the learning of the others.

Second, the schema is useful for thinking about what students get out of our classes and what constitutes a successful learning experience. For example, some students may come to class with strong affective skills but weak basic skills. Using their affective skills as a foundation, these students could focus their energies on learning content skills and use this as a springboard for improving basic general academic skills. Other students may come to class with weak affective skills but strong basic skills. In this case, students could rely on their basic skills as a foundation, and focus their energies on learning content skills and more advanced general academic skills. Success in these latter two areas would then help them to improve their affective skills. For those students with weak affective and general academic skills, successfully acquiring content skills could also come to serve as a foundation for improving other skill areas. Success will be different for different students. For example, I have had students who have barely passed my course with a D that, because of the growth they experienced in their affective skills, I would consider successful.

Third, the schema encourages instructors to expand their repertoires to include teaching general academic and affective skills as well as content. How can instructors possibly teach such different skill types and help all students progress, regardless of their initial skill sets? One promising way is to try teaching to more than one skill layer at the same time, or creating an overall learning experience that regularly cycles through teaching content, general academic, and affective skills.

Teaching Techniques and Their Target Skills

To provide one far-from-perfected example, I now turn to some of the specific teaching techniques from my own course and explain how each one connects to one or more of the skill types.

Rapport and atmosphere. From the first day of class I try to establish a positive rapport with students and create an atmosphere in class that is welcoming, respectful, and comfortable. Although it is easy to list these desirable attributes, it is notoriously difficult to spell out how to accomplish them, because it will vary from instructor to instructor and from class to class. This may include passing out a complete syllabus that reflects time and effort, offering ample office hours, coming to class a little early and lingering a few minutes for questions, never putting down a student for asking a question, including questions you have already answered, being available for one-on-one help, and being flexible with deadlines whenever possible.

A more course-centered example is what I call the hand-switch exercise. Toward the end of my syllabus I include specific advice to help students to succeed, such as forming study groups, asking questions, and so on. I preface this list by acknowledging that students often feel anxious about doing well in a course like this, but that this is due in large part to the unfamiliarity of the material and not necessarily due to lack of "logical ability." To drive this point home, I ask each of them to take out a piece of paper, copy down a definition I put up, and imagine that their entire course grade will be determined by how quickly and how neatly they can write. The hitch is that they have to write with their opposite hand. As they copy down the definition I ask them: What does your definition look like? How does it feel to write? How do you feel about your whole grade riding on this? Students laugh, grunt, and have some choice things to say in answer. But the main point is usually also taken: students' brains may feel just as uncomfortable doing logic as their opposite hand does writing under pressure, but if they stick with it, it will get more doable. The exercise also acknowledges student anxieties, communicates that everyone is in the same boat, and presents students with the idea that if they work hard they will learn the material.

Rapport and atmosphere clearly target affective skills, but the goal is not to help students acquire or develop them at this point. Rather the goal is to convince students that affective skills are significant and that they are connected to learning, especially if students come to class with performance anxieties from previous negative experiences. In this way, rapport and atmosphere are critical because they enable and encourage students to reflect on their affective skill set and to think of affective skills as part of the learning experience.

Learning and evaluation cycles. These cycles define the overall structure of my course and serve to highlight how content and affective skill acquisition can be used to reinforce one another. Learning cycles proceed as follows: (a) instructor lectures briefly on a new concept or technique, (b) students ask questions, (c) instructor provides examples, (d) students ask questions, (e) students work another example individually or in small groups, (f) whole class discusses the example, and (g) instructor moves to another concept, and the cycle repeats. In this way, content is broken down into smaller units, and students more actively engage each new concept as it comes along. The ongoing student-instructor and student-student interactions also help students feel more confident with material because if they can work and discuss an example, then they are more likely to "know that they know."

The evaluation cycle has students read the text, come to class and participate in the learning cycle described in the last paragraph, do homework outside of class, ask questions on the homework, take an in-class mini quiz on the homework, work through a mock examination, review, and finally take an in-class examination. Again, the evaluation cycle focuses on content skills. But early on in the cycle, students are given lots of support such as instructor feedback and working with peers on homework both in and out of class, which gradually diminishes as they approach the in-class examination. The idea is that the level of offered support is inversely proportional to student understanding. By structuring the evaluation cycle in this way, students learn material in manageable steps and gradually become more confident and comfortable as they progress in the cycle (Higbee, Chung, & Hsu, 2004).

Logic "labs." Unfortunately, excellent rapport and carefully crafted learning cycles do not guarantee student understanding. Because students do not always come and get help when they need it, I also began offering logic labs to encourage more students to seek help regularly. The labs are 2-hour blocks of time scheduled away from my office. Instead of having to make an appointment, students can drop by anytime during the lab and ask questions on homework, catch up on missed material, go over material again, or just sit and work on their assignments. Often students meet peers and work together; if they get stuck, then I am there to help out. Research done by a colleague and me found that students like the informal atmosphere of the labs, benefit from meeting and working with peers, and are actually more likely to seek help because a lab was available (Chung & Hsu, in press).

Because the logic labs are informal and what happens during the lab is initiated by the needs of attending students, I have helped students with all three skill types. Most often, the focus is on content skills. But students who find themselves struggling in the course have come to lab and talked through what is not working, and then we usually end up focusing on basic skills or affective skills. Finally, some students just come by the lab to chat and check their homework answers. In some instances, these conversations naturally flow into more advanced skill development such as applying logical analysis to a puzzling quote found on a Web site or discussing arguments for or against the existence of God.

"Something different" activities. After 10 weeks of learning logic, students need a break from the routine. So for three class periods all I ask them to do is come to class and participate in small-group projects that try to demonstrate the wider value of what they have learned in class. For example, the first project requires students to form groups and read through a provocative philosophy article together. Then they work through a guided discussion project that helps them identify the author's premises, conclusion, and overall pattern of reasoning. As it turns out, the pattern is one of the first rules of inference taught in the course (If A, then B; A; therefore B). The goals of the project are (a) to give students first-hand experience applying what they have learned to a real-world example, (b) to convince them that anything they read has underlying logical structure, and (c) to show them that identifying logical structure can help clarify an author's main point and how the author goes about defending it (Chung, 2004a).

Such projects explicitly attempt to foster development of general academic skills. That is, students experience what it is like to think like a logician in a different context, they move between a philosophy text and symbolic representations of its main argument, and they can see how logical concepts and analysis can help them read more carefully and critically. Ideally, experiences like this one will also help students be more disposed to apply what they have learned in their other courses.

Sneaking in basic skill development. I have already touched on basic skill development in the discussion of the logic lab and the something-different activities, but a final word is in order given the centrality of this skill set for students considered at risk. Some readers might be surprised that more explicit attention is not given to helping students read a logic text, take notes, study, or write coherent answers on exams. Even if such help is available in logic lab, this seems insufficient. Part of the challenge here is that the majority of students firmly believe they *already* know how to do all of these things, and, in my experience, their initial reaction to explicit basic skills instruction is to be insulted. Additionally, students do not all need the same levels of help. If students end up failing the first major exam, then they are usually more open to talking about such skills, and it can be easier to initiate a conversation, but at that point they are also usually focused on their grade and what to do about it to the exclusion of anything else.

In the face of these challenges, my strategy is to "sneak in" basic skills instruction. For example, even while focusing on content skills, I occasionally have students read selected passages from the text and try to model how to pull out salient points. During lecture I pause and explain how to take good notes, how to structure and organize a notebook, and how to use it to study. As exam dates approach, I provide handouts with samples of short answers, a mock examination for practice, and I offer specific test preparation tips, such as using flash cards to help in learning translation conventions.

In addition I provide "grade trackers," in both print and electronic versions, that allow students to record their scores and calculate their current cumulative grade as work is returned. At weeks 5 and 10 I distribute updated grade trackers based on my records, and I encourage students to compare their version with mine. In this way, students know exactly how they are doing in the course, and it encourages them to monitor their progress regularly.

By describing my approach to basic skill instruction as "sneaking in," I do not mean to belittle these skills or their importance to developmental education students. In fact, I deliberately do not cover as much content as my colleagues in the philosophy department so I have the time to weave in basic skills instruction. But, based on my own experience, I have found that students do not completely lack these skills so much as they lack the disposition and knowledge of how and when to use what skills they have effectively. Students need to be reminded of the benefits of being mindful of such basic skills, and peppering them with concrete examples and tips seems to be an effective way of accomplishing this goal.

Some Evidence in Support of the Integrated Skills and Content Approach

Even though the main goals of this chapter are to characterize and exemplify the integrated skills and content approach to developmental education, readers may be wondering whether there is any empirical evidence in support of such an approach. For example, are students satisfied with the logic course as described here, and is there any evidence of metacognitive development? I have not had the opportunity to gather data that explicitly address these questions. However, the results of one end-of-semester survey and aggregate data from 4 years of student evaluations of the course offer positive, if indirect, support.

At the end of the fall 2001 semester, I administered a short five-item survey to students. The results indicated that 92% of students thought that the pace of the course was about right, and 90% thought that the amount of material covered was about right for an introductory course (N = 65). Student evaluations of the logic course between fall 2000 and spring 2004 (13 sections, N = 476) provide a range of data on student perceptions of the course. For present purposes, two items are worth highlighting. First, students were asked to rate how much they learned in the course on a seven-point Likert-type scale where 1 represented "almost nothing," 4 represented "amount expected," and 7 represented "an exceptional amount." For this item, the average student response was 6.2, with 79% of respondents choosing either 6 or 7. Second, students were asked to respond to the following statement: "Instructor stimulated me to think critically about course materials (yes/no)." For this item, 98% of students enrolled in the logic course answered "yes."

Clearly this data needs to be complemented by more rigorous studies that are comparative, longitudinal, and go beyond student perceptions. Nonetheless, the value of student perceptions should not be discounted. Overall, the data presented indicate that students are generally very satisfied with the logic course, that they are learning quite a bit, and that they believe they are being challenged to think critically.

Conclusion

In this chapter, I have provided one example of an integrated skills and content approach to working with students considered at risk. As exemplified by my logic course, such an approach attempts to integrate the instruction of content skills, general academic skills, and affective skills, thereby expanding the traditional focus of stand-alone courses on basic general academic skills. The success of my particular course hinges on two key elements: teaching techniques designed to provide meaningful learning experiences at multiple skill layers and an ongoing awareness of and attention to affective issues that foster student motivation and confidence.

The integrated approach avoids shortcomings that plague the stand-alone model. First, because students are enrolled in regular college-level classes, they are less likely to feel the same stigma associated with "pre-college" or "remedial" courses. Second, because integrated courses can earn full college credit, students are more likely to make timely progress toward their long-term educational goals.

In addition, an integrated skills and content approach embraces a more dynamic conception of skills compared to the stand-alone model. Instead of a stage conception of skills that are hierarchically related, the integrated approach views skills as interdependent, mutually enabling, and as potentially providing meaningful context for each other. For example, learning specific content skills can provide a meaningful context for the acquisition and development of general or affective skills, while for some students making progress in their affective skill set may be the key to overcoming content skill difficulties.

Also, by embedding basic skill development within the learning of regular course content, the integrated approach avoids tacitly assuming that basic skills readily transfer to new contexts. Instead, by explicitly reintroducing basic skills in each new content area, it can be argued that the integrated approach actually reinforces these skills and increases the likelihood that students will acquire and develop them.

Finally, an integrated skills and content approach does not attempt to place all students considered at risk into a standardized set of basic skills courses. Instead, this approach acknowledges that different students come to the classroom with a variety of skill sets, and it tries to construct learning experiences that will teach to multiple skill levels simultaneously. In this way, the integrated approach acknowledges and accommodates student diversity more readily.

All in all, an integrated skills and content approach does not solve all the challenges faced by developmental education professionals and, as exemplified by the logic course, it certainly does not guarantee success for every student. As part of a comprehensive developmental education curriculum, however, I believe I have shown that it is definitely a move in the right direction.

References

Boylan, H. R., & Saxon, D. P. (1998). The origin, scope, and outcomes of developmental education in the 20th century. In J. L. Higbee & P. L. Dwinell (Eds.), *Developmental education: Preparing successful college students* (pp. 5–13). Columbia, SC: National Resource Center for the First-Year Experience and Students in Transition, University of South Carolina.

Casazza, M. E., & Silverman, S. L. (1996). *Learning assistance and developmental education*. San Francisco: Jossey–Bass.

Chung, C. J. (2004a). Enhancing introductory symbolic logic with student-centered discussion projects. *Teaching Philosophy, 27*(1), 45–59.

Chung, C. J. (2004b). The impact of attendance, instructor contact, and homework completion on achievement in a developmental logic course. *Research & Teaching in Developmental Education, 20*(2), 48–57.

Chung, C. J., & Hsu, L. (in press). Encouraging students to seek help: Supplementing office hours with a course center. *College Teaching*.

Higbee, J. L., Chung, C. J., & Hsu, L. (2004). Enhancing the inclusiveness of postsecondary courses through Universal Instructional Design. In I. M. Duranczyk, J. L. Higbee, & D. B. Lundell (Eds.), *Best practices for access and retention in higher education* (pp. 13–25). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Maxwell, M. (1997). *Improving student learning skills: A new edition*. Clearwater, FL: H & H.

Pedelty, M. (2001). Stigma. In J. L. Higbee (Ed.), *2001: A developmental odyssey* (pp. 53–70), Warrensburg, MO: National Association for Developmental Education.

Perin, D. (2002). The location of developmental education in community colleges: A discussion of the merits of mainstreaming vs. centralization. *Community College Review, 30*(1), 27–44.

Roueche, J. E., & Roueche, S. D. (1999). *High stakes, high performance: Making remedial education work*. Washington, DC: Community College Press.

Simpson, M. L., Hynd, C. R., Nist, S. L., & Burrell, K. L. (1997). College academic assistance programs and practices. *Educational Psychology Review, 9*(1), 39–87.

Standards for Success. (2003). *Understanding university success*. Eugene, OR: The Center for Educational Policy Research.

Tobias, S. (1978). *Overcoming math anxiety*. New York: Norton.

CHAPTER 17

Teaching Thinking and Reasoning Skills in a Science Course

Leon Hsu

ABSTRACT

In this chapter I discuss the features of a physics course for which the primary goals are to sharpen students' thinking and reasoning skills and to improve their metacognitive abilities. Although physics is not a traditional part of a developmental education curriculum, the aims of the course have much in common with those of traditional developmental reading, writing, and mathematics courses. The science content helps accomplish the goals by providing an ideal context in which students can practice critical thinking skills.

As with the other chapters in this section, this chapter focuses on how one can design a content course to help students develop the skills they need to succeed in higher education. In the following pages, I describe how I am attempting to develop students' skills in both critical thinking and metacognition in the context of a university physics course.

One goal of many developmental education curricula is to raise the level at which students are able to think and reason (Pogrow, 1992). Half a century ago, a group of educators led by Benjamin Bloom developed a classification of intellectual behavior in three domains related to learning—the cognitive, affective, and psychomotor. In the cognitive domain, they described a taxonomy of educational objectives consisting of six levels of abstraction into which questions commonly asked in educational settings could be categorized (Bloom, 1956). In order of increasing complexity and sophistication, the categories were knowledge, comprehension, application, analysis, synthesis, and evaluation. The last three of these objectives comprise what are commonly referred to as "critical thinking skills." The importance of improving students' critical thinking skills is reflected in the fact that the *Journal of Developmental Education* publishes a regular column on critical thinking (e.g., Paul & Elder, 2004).

Another important goal of many developmental education efforts is to help students develop metacognitive skills (Stahl, Simpson, & Hayes, 1992).

Metacognition, literally "thinking about thinking," refers to the ability of a learner to monitor his or her own learning of new knowledge through activities such as restating the new knowledge in the learner's own words, trying to explain the new knowledge to someone else, or comparing the new knowledge to previously learned knowledge. Successful students often possess well-developed metacognitive skills, which help them to recognize situations in which they need to adjust their learning strategies or obtain further help in order to succeed (Butler & Winne, 1995).

At the General College, I teach a physics course for which the primary goals are to help students develop both critical thinking and metacognitive skills. Although taught as part of a developmental education program, the science content of the course is not remedial or watered down in any way. In fact, the same curriculum is used in courses taught in physics departments at many postsecondary institutions around the country. In the following pages, I discuss the role of a science course in a developmental education program and why science is an ideal context in which to teach such skills. I also describe the structure of my course in detail, giving specific examples of how the curriculum and the assignments contribute to fulfilling those goals.

The Role of a Science Course in a Developmental Education Curriculum

The idea of teaching a physics course as part of a developmental education curriculum is not a traditional one and may strike many readers as unusual. After all, science, especially physics, is typically considered one of the more difficult subjects in college, requiring competency in reading, writing, and mathematics. Would it not make more sense for students to hone their skills in these areas first by taking more traditional developmental courses before attempting a science course? From my point of view and that of the General College, the answer is no.

One basic reason it can be beneficial for students to take a science course such as physics right away is that the demands on students in such courses are similar to those in many other college courses that students take to earn their degree. Students must work on assignments outside of class, study for exams, come to class prepared to discuss the subject material, and learn to work productively with other students. During the semester, some students find that they are unable to complete the assignments or to understand the material on their own and must seek help from either the instructor or their peers. In a typical college course, the instructor assumes that the students are all well prepared to handle these tasks without any support, making the courses difficult for many students. However, within a developmental education program, the class can be structured to meet students at their present level and help them improve their ability to fulfill these demands.

A second reason for including a science course is that such courses can provide students with the motivation for working hard and doing well if it is a subject in which they are or become interested. Furthermore, there is evidence that learning thinking skills in the context of a content course, rather than in a course dedicated to study skills, can make it easier for students to transfer those same skills to their future courses (Anderson, Greeno, Reder, & Simon, 2000; Cobb & Bowers, 1999).

Finally, as a practical matter, including content courses such as physics as part of the curriculum for students in a developmental education program can help them to graduate more quickly. Developmental reading, writing, and mathematics courses often do not count towards graduation, and in some places they have come under attack by state legislatures (Arenson, 1998; Irving, 1995; Wessel, 1998). However, virtually all postsecondary educational institutions require students to take at least a few courses from a wide variety of fields, including science, as part of a core curriculum. A strong argument can be made for allowing a physics course, even one taught as part of a developmental education program, to count towards fulfilling the core curriculum requirements, making it possible for students to complete graduation requirements at the same time that they are acquiring the skills necessary for coping with future college courses.

Science courses offer excellent opportunities to help students develop critical thinking skills, and there is a large body of research in the science education literature about effective ways to teach such thinking and reasoning skills (Adams, 1993; Eliason, 1996; Hogan, 1999; Lawson, 1985; Zimmerman, 2000). Science is about making sense of the world and figuring out how things work from observations of real-world phenomena. This process of deducing rules from observations and of designing systematic experiments requires extensive use of the skills that make up "critical thinking." In the context of Bloom's Taxonomy of Educational Objectives (Bloom, 1956), students must *analyze* the outcomes of experiments and decide what conclusions can be drawn, and they must *synthesize* several observations to devise general rules about whole classes of phenomena. Where multiple observations provide contradictory or seemingly contradictory conclusions, students must *evaluate* the validity and quality of the observations. These types of thinking skills are useful not only in science courses, but also in almost every other course, field of study, and profession.

Science courses also provide natural opportunities for students to collaborate. Virtually all science courses with a laboratory component have students working in small groups, providing opportunities for students to get to know each other and to form social bonds. These bonds, in turn, can provide students with support networks during their first years in college and improve retention (Fullilove & Treisman, 1990).

Finally, based on responses to a survey given at the beginning of the semester in my class, about one third of the students believe that physics is a demanding subject that they will have difficulty understanding. This attitude usually stems from negative experiences in previous science courses, whether in high school or college, or from conversations with peers. However, in modern society where science and technology play a major role in every aspect of life from medical procedures to consumer electronics to the newest diet fads, it is more important than ever that citizens feel comfortable discussing and thinking about science and see it as something they can understand and make decisions about. A science course geared to the needs of its students could make great strides in giving students the skills and confidence they need to deal with the science they will encounter in their lives.

The General College Physics Course

The majority of students enrolled in the course I teach, hereafter referred to as GC 1163, are taking it to fulfill the university's core curriculum requirement for a physical science course with a lab. Between 5% and 10% of the students plan to take further courses in physics at the University of Minnesota, but they do not feel ready to jump into the physics department's own introductory course and are using the class as a warm-up. Most students are in their first year of college, with a sprinkling of second-year students.

Goals

GC 1163 is somewhat different from most science courses in that the primary emphasis is on developing students' thinking and reasoning skills. Learning science facts is secondary. In order of importance, the four main goals of the course are for students to:

1. Develop scientific thinking and reasoning skills, including the ability to make careful observations, to develop coherent and consistent explanations of how things work based on those observations, to design and conduct controlled experiments to test the validity of their explanations, and to modify those explanations to fit new data, if necessary. I have made this the primary goal because not only are such thinking skills the foundation of doing science, they are also applicable to any field in which students may be interested, whether it is a head of a company developing a business strategy based on current market trends, a doctor prescribing a treatment regimen based on a patient's symptoms, or an engineer prototyping a structure to meet a client's

requirements. In addition to the general skills of analysis, synthesis, and evaluation described earlier, scientific thinking skills include the ability to interpret and generate graphs and charts and to use proportional reasoning.

2. Develop metacognitive skills. Students will develop an explicit awareness of the study strategies they use and of the relative effectiveness of their strategies. Such knowledge can help students succeed in future courses by making them more efficient learners who are better able to monitor their own learning and to adjust their learning strategies as necessary to cope with different courses.

3. Learn that science is a process of discovery and testing in which they themselves can participate. Students taking introductory science classes tend to think that science is a collection of facts and theories discovered by "smart" people doing complex experiments and that learning science means learning those facts and theories through listening to a lecture by a person of authority (Hammer, 1994; Roth & Roychoudhury, 1994; Ryan & Aikenhead, 1992). Although this is certainly one aspect of science, I would also like students to learn that doing science means developing the best possible theories for explaining and predicting real-world phenomena based on limited and possibly imperfect evidence. Sometimes, further investigations confirm the original theories. At other times, new evidence forces a revision or reconsideration of what were thought to be well-established theories. Students often have a great fear of being wrong, but in science, it is OK to be wrong as long as your proposed ideas fit the evidence available at the time.

4. Learn some basic physics concepts. In the process of conducting experiments and developing explanations for the results, students will learn about some of the laws that govern how the universe works. However, science knowledge merely provides the context for practicing critical thinking skills. Learning as many science facts and theories as possible is not the main goal of the course. In fact, if the rote learning of science facts were the only goal, it would be far faster, easier, and cheaper to read a good book than to take a one-semester college class.

My downplaying of the science content in favor of developing thinking skills might horrify some science teachers. However, I made this decision as a result of asking myself the question "What would you like these nonscience majors, for whom this is likely the only science course they will ever take, to get out of this class?" Although it is tempting to talk about topics that I personally find very interesting and that have captured the imagination of the public such as black holes, quantum mechanics, and special relativity, I decided in the end that I wanted my students to take away the kinds of knowledge and skills that would be difficult to gain from reading a book. These include critical thinking and metacognitive skills, a knowledge of what science is and what scientists do, and a sense that they themselves are capable of performing experiments to understand the universe and the technological devices they use every day.

Curriculum

The curriculum used in GC 1163 is known as "Physics by Inquiry" (PbI; McDermott & Physics Education Group, 1996) and was created by the Physics Education Group at the University of Washington. It had been noted that students from groups underrepresented in science had a higher rate of failures and withdrawals from the standard introductory physics course than other students (Rosenquist, 1982), and PbI was developed as a preintroductory physics course to help those students succeed. Although college students taking introductory physics are usually assumed to understand basic scientific concepts such as mass, volume, and density, and to be proficient in mathematical thinking skills such as proportional reasoning, research shows that a significant number of students do not and are not, and that this lack of understanding and proficiency impedes their learning (Arons, 1990). The PbI curriculum was developed to ensure that students have a thorough grounding in these skills before enrolling in introductory physics. Even though the vast majority of the students in my class do not intend to take any more science classes, the PbI curriculum is also appropriate for the goals outlined earlier.

During the more than 2 decades of development of PbI, the Physics Education Group at the University of Washington has used pre- and posttests, as well as interviews with individual students, to gauge the effectiveness of the curriculum and to guide revisions to the activities (McDermott & Shaffer, 1993; Shaffer & McDermott, 1993). Even now, this work continues.

The textbook for the PbI curriculum is divided into several units, each addressing a different type of physical phenomenon. Some of these units are Properties of Matter, Heat and Temperature, Light and Shadows, Astronomy by Sight, Electric Circuits, and Kinematics. The text differs substantially from traditional science textbooks in that it is not meant to be read and contains very little information. Instead, it is more like a laboratory manual with instructions about experiments to perform and questions to think about in considering the results of those experiments.

Some of the questions ask students to find a pattern in their experimental results and to develop a theory that explains them or to explain the results in terms of a theory they previously developed. Other questions ask students to use their theory to predict the outcome of an experiment before performing it. Yet another type of question presents a short discussion between two or three people and asks students to evaluate the correctness of each of the statements in the discussion, which are written to reflect the common difficulties and confusions that students have. All of the questions put a great deal of emphasis on students' ability to explain physical phenomena using a mental model of how things work. Very few ask only for a factual answer. Students perform the experiments and discuss the answers to the questions in small groups.

As an example, the unit on Electric Circuits begins by asking students to light a small bulb using only a battery and a single wire and to examine arrangements of these objects that do and do not make the bulb light. Students thus develop the concept of a circuit and how a closed path is necessary to light the bulb. Students then test materials such as iron, rubber, paper, and copper to see which ones are useful for making working circuits. They also examine in detail common circuit components such as bulbs, sockets, and switches to determine how they work.

Next, students begin to build a mental model, or theory, of how more complicated circuits work. They are first given two rules for circuits that are too difficult to infer by direct experimentation at this level: (a) that there is something flowing in the wires called electric current, and (b) that the brightness of a bulb is an indicator of how much current is flowing through it. Students then connect circuits with two bulbs in two different arrangements and use the rules to judge whether the amount of current coming from the battery is the same or different as in a circuit with only one bulb. Because the answers are different than what almost all students initially think, they are challenged to reason out the answer using the given rules and the experimental evidence, rather than their own incorrect intuitions.

Subsequently, students tackle even more complex circuits, and by the end of all the activities they are capable of predicting and explaining the behavior of complicated circuits with multiple batteries and bulbs and of making quantitative calculations of currents and voltages in such circuits. In the process, students use experimental evidence to invent their own rules for determining the behavior of more complex arrangements of circuit elements and revise those rules as they try new arrangements.

After every few experiments, there is a designated checkpoint. Each group calls over a member of the course staff who checks to make sure that the experiments have been performed properly and that the group discussions have led to explanations and theories that are consistent with the results. The checkpoints are very important for insuring that the students' thinking processes are well grounded. The instructor or a teaching assistant can point out any experimental evidence that the students may have overlooked or any gaps in the students' chain of reasoning.

In summary, the PbI curriculum provides students with laboratory experiences in which students must interpret and synthesize experimental results to develop theories that can explain and predict the physical phenomena they see. By working in small groups, students simulate the process by which professional scientific investigations are conducted, advancing their own theories and checking to see that other students' theories are consistent with the experimental evidence. These activities help them to hone their thinking and reasoning skills.

Students at the University of Washington taking the PbI course subsequently passed the standard introductory physics class at rates comparable to the students who were not deemed "at-risk" by the school (Rosenquist, 1982). Since then, the course has evolved into a two-quarter sequence serving both students from underrepresented groups interested in pursuing a science or technology major and preservice elementary and secondary teachers. For the preservice teachers, this class helps students develop their scientific thinking and reasoning skills and gives them experience with an interactive hands-on curriculum. This experience is crucial because modern elementary and middle school science curricula now have substantial hands-on components. Teachers must be proficient at scientific reasoning and at using evidence to develop scientific models of how things work in order to be effective in helping their students learn.

Implementation

Because the main goal of GC 1163 is to help students improve their thinking and reasoning skills by devising their own theories and explanations from experimental evidence, the class is conducted entirely in a laboratory setting, with two 165-minute sessions each week and a short break in the middle of each session. There are no lectures because lectures would only reinforce the idea that science is a body of knowledge that is handed down from an authority. Furthermore, students cannot be expected to improve their critical thinking skills through listening to a lecture any more than they could be expected to become expert tennis players merely through attending lectures (Carey, 1986; Cooper & Mueck, 1990; Farnham-Diggory, 1992). Active practice that includes individualized guidance and feedback is crucial, and any class that teaches critical thinking skills includes such practice.

In a nontraditional class such as this, it is critically important to get students to "buy-in" to the instructional methods as early as possible. On the first day of class, I describe in detail the types of activities students will be performing in class, such as the pre- and posttests, the lack of lectures, and the emphasis on student explanations of reasoning, along with the rationales for them. In this way, students who strongly believe that lectures are the only way to learn or who dislike working in a group can transfer to a more traditional class. The students who remain understand what will be expected of them and are willing to put their time and energy into the activities.

Based on research in forming effective cooperative groups (Johnson, Johnson, & Anderson, 1983; Johnson, Johnson, & Smith, 1998; Slavin, 1983), students work in groups of three. The groups are initially formed by random selection. Approximately 4 weeks into the semester, after the first exam, the groups are shuffled according to students' performance on the exams, each group consisting of three students who scored in the upper, middle, and lower third of the class. Naturally, students are not informed of the criteria on which the groups are based. They are told only that it is good for them to learn to work with different lab partners. By forming groups in this manner, there is almost always someone in each group who has an idea of how to proceed. The weaker students can benefit from the knowledge of the stronger students, and the stronger students benefit from having to articulate their thinking to the weaker students (Heller, Keith, & Anderson, 1992). To encourage students to work cooperatively and to reduce the incidence of students freeloading off of their partners or refusing to participate, 5% of each student's grade is based on a series of both self- and peer-evaluations of his or her contribution to the group's learning. In addition, if a group's average exam score is 80% or higher, then all group members earn a 5% bonus on their individual exam scores.

Another benefit of having students work in groups is the reduction in the need for assistance from the staff, as students can answer each other's questions. Also, forming long-term groups enables students to get to know each other better than they would in a traditional class and gives them a source of social and academic support, which has been shown to be important in the retention of college students and can help insure regular attendance from each of the group members (Astin, 1993).

There are typically about 45 students forming 15 groups in the class. Because the checkpoints are intended to be performed with individual groups and can take a significant amount of time, it would be difficult for me to run the class by myself. To assist me in answering students' questions and conducting the checkpoints, I have hired undergraduate teaching assistants (TAs). Such support is not absolutely necessary, however. Instructors without TAs have been able to implement this curriculum in classes of up to 70 students by conducting the checkpoints with the entire class rather than with individual groups (Scherr, 2003). In this case, the checkpoint questions are deliberated by all of the students in the class at the same time in a discussion led by the instructor.

The TAs are students who have taken GC 1163 previously and have both done well and shown an ability to interact productively with other students. Because the primary goal of the course is for the students to improve their thinking and reasoning skills, the TAs are trained not to give students answers. Instead, they ask questions that will lead the students to reason out the answers for themselves.

Because the ability to ask such questions requires a thorough knowledge of the material and an awareness of some of the common difficulties students have, extensive training of the TAs is required. Each week I conduct a 2-hour training session for the TAs. The TAs first work through the activities that the students will be doing that coming week. Although the TAs have already taken the course, it is necessary to refresh their memories and for them to be aware of potential pitfalls or difficulties. Next, the TAs and I discuss the checkpoint questions we will ask the students, along with common misconceptions and difficulties that students have. Such preparation helps the TAs to ask good questions.

Pedagogy

The pedagogy of the class is based on the cognitive apprenticeship model (Brown, Collins, & Duguid, 1989; Collins, Brown, & Holum, 1991). In this paradigm, students learn cognitive skills in the same way that apprentices learn a trade from a master. As will be described in the following paragraphs, the crucial elements of a cognitive apprenticeship are modeling, scaffolding, fading, and coaching.

In a traditional master-apprentice relationship, modeling occurs when the master demonstrates the work to be done to the apprentice. In GC 1163, one type of modeling occurs during the first and last 15 minutes of each class. During these times, a short "Question of the Day" (QoD) is presented for the students to answer. The QoD deals with material that students have previously encountered and functions either as a warm-up at the beginning of class to get students into a science frame of mind, or as a wrap-up at the end of class of what they have just learned. After the students' answers to the question are collected, I model the problem-solving process by demonstrating how one can solve the problem. The critical feature of this modeling is that I make the thought processes involved in answering the question explicit, showing students how to solve such problems in general, rather than simply getting the answer to one particular question.

As an example, a problem might ask students to predict the relative brightnesses of the bulbs in a complicated electric circuit. In demonstrating how to solve this problem, I would show the students how they can use the rules they developed in class to trace the path of the electric current through the circuit and determine which bulbs would receive the greatest amount of current. This would give students a way to determine bulb brightnesses not only in the circuit in question but also in any other circuit they may encounter.

A second type of modeling, peer-modeling, also takes place in GC 1163. In class, students observe the other members of their group presenting their explanations for the experiments or their answers to the questions in the textbook. Outside of class, students may observe each others' reasoning processes while working on homework problems.

Scaffolding is the help that an apprentice receives while practicing a task, and fading is the gradual withdrawal of that help, forcing the apprentice to work more independently. Coaching refers to the guidance and feedback the apprentice gets throughout the training process. During the class, all three of these functions are accomplished as the students work on the activities with their groups and receive help from peers and the course staff. As students perform the activities, they discuss the results of their experiments and the answers to the questions posed in the text with the other members of their group. Because the questions in the text almost always demand that students explain the reasoning behind their answers, the students are forced to make explicit the thinking processes by which they arrived at their answer. The other group members then evaluate the proposed answers and explanations. If a group is stuck, a staff member helps by asking questions that lead the students to discover the answer for themselves. The questions serve to bridge the gap between the group's current state of knowledge and the correct answer by reducing the size of the logical steps the students must take. In addition, during each checkpoint one of the course staff reviews the material with each group by asking the students to explain key results from that section and posing further questions about related hypothetical situations. The student-student and student-staff interactions constitute the scaffolding and coaching. As the course progresses, the students are expected to have improved their thinking abilities, and the staff may ask more difficult questions or give the students hints that require more thinking. This is the fading process. Ultimately, of course, students must be able to answer questions on an exam on their own.

Addressing Class Goals

All of the activities in which students engage during class are designed to help them meet the four class goals outlined previously. The connections between the assignments and the goals are made explicit to students in order to help them focus on the knowledge and skills they should be gaining from an assignment, rather than on simply completing it. The course assignments that support each of the four goals are described in the following paragraphs.

Learning scientific thinking and reasoning skills. Students accomplish this goal principally through performing the experiments and discussing the results and questions from the text with their lab partners and the course staff. The problems on homework assignments, tests, and QoDs reinforce the importance of critical thinking skills by constantly asking students to explain the reasoning by which they arrived at their answer. Furthermore, students keep careful notebooks of their class work, and they are always allowed to use these notebooks while doing homework and taking the exams. Doing so places the emphasis on being able to write logical and experimentally-justified explanations on essay-type exam questions, rather than on memorizing facts or outcomes to specific experiments. Finally, homework and exam questions often present situations that the students have never encountered before, but which they can analyze successfully if they apply the rules they have devised.

In the grading of exams, much weight is placed on the explanation that students give. A correct answer that is accompanied by a poor explanation will receive less credit than a wrong answer that is explained well and has only minor mistakes in the reasoning process.

Developing metacognitive skills. There are two mechanisms by which students learn to monitor and reflect on their learning. The first is through a series of journals. Each week, students are required to submit a journal entry in response to some specific questions. These questions ask students to reflect on the assignments in the class, the study strategies they are using, and the effectiveness of their study habits. To encourage students to generate well-considered responses, these journals are graded subjectively by me on the amount of thoughtfulness displayed. Responding to these questions can help students to become aware of how they learn and to realize what strategies are most and least effective for them.

For example, in a journal entry early in the semester, students reflect on how they are coming to learn the material in GC 1163:

1. Name an important concept you have learned in sections 1, 2, or 3. Why do you think this concept is important?

2. How did you learn the concept? Was it because the instructor told you about it, or did you learn it through performing a particular experiment? If so, what experiment was it?

3. Were discussions with your group partners useful in learning the concept?

A couple weeks later, I ask students to reflect on the class assignments:

The assignments in this class are homework, exams, exam revisions, pretests, posttests, Questions of the Day, and journals.

1. Which of these help you to understand physics concepts better?

2. Although the journal items have not been directly related to physics concepts, have they helped to get you thinking about how you learn the concepts and how best to approach this course?

3. Has having pre- and posttests for each section helped you to internal-

ize the concepts you are learning? Do you see any advantage in having pretests at the start of every section?

Near the end of the course, I ask students to synthesize what they have learned by reflecting on their study habits:

> Suppose that you were explaining to your friend Diana, a student just like you (with the same ability and intelligence) who is thinking of taking GC 1163, exactly what is expected and how to understand what is happening in class. She wants to know what she should do and how to study for the class in order to be able to learn best. Diana really wants to understand the material and does not care too much about her grade, as long as she can pass.

If students do not object, I post their submissions anonymously on the class Web site so interested students can see the wide range of points of view held by their peers. In addition, if a student's response piques my interest in some way, I will respond to a student by e-mail.

A second way in which students reflect on their learning is through an evaluation of their group and the roles they play in their group members' learning of the material. Approximately once per week, time is set aside for students to discuss their group's strengths and weaknesses and to evaluate each member's contributions to the group's learning. Some questions they discuss are:

1. Have you had any experience in working in groups in your other classes? Is the group work in this class any different from the group work in other classes?

2. What are some ways in which your group functions well?

3. What are some changes that could be made to improve how well the members of your group learn?

4. What are some things each group member could do to help the functioning of the group?

5. What do you like best about your group?

Affecting students' attitudes and epistemologies of science. The grading scheme and emphasis on thinking and reasoning in GC 1163 are designed to give students a more realistic sense of science. Because paramount importance is placed on the ability to draw conclusions and to develop explanations that are based on and consistent with experimental observations, students' theories that differ from the accepted ones, but that are consistent with observations, are considered correct and receive full credit.

Many students are initially uncomfortable with this way of learning science and dislike the fact that the instructor and TAs will not simply tell them the right answer. However, this policy has three advantages:

1. Because students are forced to develop their own explanations and theories, they are likely to remember them better and to use them more spon-

taneously. The mental processing students perform to devise a theory is much deeper than if they had simply read or been told about it.

2. Students see that they can do science and develop for themselves the same scientific principles and laws that they have read about in textbooks. The process by which those laws were discovered is no longer mysterious.

3. It becomes clear to the students that, as in real science, any testable theory that fits the experimental evidence must be taken seriously.

Situations in which an incorrect explanation is consistent with the experimental results are relatively rare, however. Over the more than 20 years of development of the PbI curriculum, the experiments have been carefully designed so that ordinarily, students cannot help but arrive at the commonly accepted theories. Although alternative explanations might work during the early sections of a unit, students soon gather additional experimental evidence that forces them to modify their theories to resemble the established ones. However, it is important to note that it is the students themselves who direct the development of their theories using experimental evidence and not the course staff or some other figure of authority.

Learning science content. When students first enroll in an introductory science course, they often have ideas that are very different from those of practicing scientists (Halloun & Hestenes, 1985; McCloskey, 1983). Much research has shown that these initially held ideas are highly resistant to change, making learning new concepts that conflict with them very difficult (Dykstra, Boyle, & Monarch, 1992). This is particularly true when trying to help students learn concepts in such a way that they can be applied flexibly to a wide variety of situations, and not just parroted back as a simple definition or law. Simply presenting students with new knowledge through a lecture or having them read a textbook has been found repeatedly to be an inefficient mode of learning for the vast majority of students (Hake, 1998).

The method by which students learn new concepts in GC 1163 is based on the conceptual change theory of Posner, Strike, Hewson, and Gertzog (1982), which stated that the replacement or modification of students' initial nonscientific conceptions can only occur when students (a) become dissatisfied with their initial ideas, (b) explore possible alternatives, and (c) choose an alternative that fits their needs.

Before starting each section within a unit, students take a pretest consisting of questions dealing with material from that new section. Naturally, the students are not expected to be able to answer the questions correctly. In fact, students usually answer them incorrectly because the questions are specifically chosen to address common misconceptions they have before learning the new material. However, the questions are always posed in such a way that they can be understood and answered by the students. The students then work through the new section. As mentioned previously, many of the questions in the textbook ask students to make predictions about situations that they have never encountered before setting up those situations and observing the actual result. Both of these mechanisms, pretests and predictions, are designed to elicit students' ideas about science and to make students articulate them explicitly. After performing the experiment, if the students find that their initial ideas lead them to an incorrect prediction, then they become dissatisfied with those ideas.

Next, students discuss alternative ideas with their peers, and these ideas can be evaluated based on how well they fit the observations. Finally, the group chooses an idea that it thinks works best. During this process, the role of the instructor and TAs is merely to facilitate the thinking process and to help the students brainstorm lines of thought. It is not to advocate one idea over another or to tell students which idea is "right." Further experiments might confirm a group's ideas or show the students that further modifications to their theories are necessary.

After each section, the students return to their pretest and revise their answers. This serves both to help solidify the students' new ideas in their minds and also to provide the students with evidence that they are learning.

Assessment

I have used several methods of assessment for GC 1163 to evaluate how well the course is meeting its goals and also to obtain guidance in improving the course. Because the course has been taught only for a few semesters using this curriculum, the data is still limited.

One type of assessment is to measure student satisfaction with the course. Although student satisfaction is not necessarily correlated with how effectively the course goals are being met, it is important in the sense that if the course is unpopular, only a few students will enroll, and it may not continue to be offered. I measure student satisfaction using three techniques. The first is by the Student Evaluation of Teaching forms. These evaluations, which are completed near the end of each semester and are similar to the student evaluations at hundreds of other universities and colleges, allow students to give anonymous individual feedback about the course by either writing comments or rating some standard items such as "Instructor's knowledge of the material" or "Instructor's respect and concern for students" on a seven-point Likert-type scale.

A second technique for getting feedback on student satisfaction is through the weekly journals. In addition to helping the students develop metacognitive skills, the weekly journals provide an avenue for students to give me feedback about how the course is going for them. For example, one of the journals asks the students if they think that the exam questions have been fair and if not, which one was the most unfair and why. As was mentioned previously, I respond to the students' submissions by e-mail if it seems appropriate.

The third technique used to obtain student feedback is called Small-Group Instructional Diagnosis (SGID; Coffman, 1991). In SGID, a staff member from the university's Center for Teaching and Learning comes to the class and conducts a 30-minute focus group with the students. The session is conducted without any of the course staff present so students feel comfortable voicing their opinions. The students first meet in small groups that are different from the ones they normally work in during the class to make lists of features that they like about the course and those they feel should be changed. A whole-class discussion is then held to find items of both types on which there is a consensus. This kind of evaluation allows the instructor to identify strengths and weaknesses of the course that a large proportion of the class agrees upon, rather than just the feelings of what might be a very vocal minority. SGID also gives students a chance to hear what other students think of the class.

Thus far, the vast majority of students who have taken the course are happy with it. Consistently, more than 95% of the students completing the anonymous university course evaluation forms respond positively to the statements, "Instructor stimulated me to think critically about the course material" and "I would take another course with this instructor." Often cited as strengths on the evaluations are the fact that students interact extensively with their peers and get to know them well, that they enjoy the hands-on learning, and that they appreciate and find helpful the individual attention they get from both the instructor and the TAs. The journals have also allowed me to see to some extent how student attitudes towards science have changed. Last semester, out of 43 responses to a question on how their attitudes towards science had changed from the beginning of the course to the end, 32 students reported having a better attitude, and 11 students reported no change. Some responses typical of the students who reported an improved attitude were:

> Before I took this class I was deathly afraid of physics. I had heard so many horror stories about how hard the material was and how the tests were so difficult. Now that I have experienced this course my attitude has changed. Sure it was difficult for me at times to understand the material, but it is all a part of learning. I am glad that I had the opportunity to take the course in the style it was presented in.
>
> I didn't take physics in high school because I was told it was really hard by everyone, which scared me away since I'm terrible at science. Now I know that physics isn't all about math, it's about learning the way things work. To me, that is much more interesting.

To assess whether students have improved their scientific thinking skills, I have used Lawson's (1978) Test of Scientific Reasoning. Each semester, I have given the test on both the first and last day of class. The difference between students' pre- and posttest scores has been statistically significant but small, going from an average of 12 to 14.5 questions answered correctly on the 24-question test. One confounding factor in using this test is that it was originally developed for use in a biology class, and many of the questions are posed in a biology context. Because some transfer of thinking skills from a physics to a biology context is required, the interpretation of the results of this test is not straightforward. Individual interviews with students will be necessary to obtain more detailed information about their reasoning abilities.

An instrument I have used to measure the affective impact of the curriculum is the Rotter (1966, 1990) Internal:External Locus of Control scale. This is a survey developed to assess to what extent students believe they have control over events in their lives. Students with an internal locus of control generally believe that their own actions play a large part in what happens to them (e.g., that their grade in a class depends on how much effort they put into the class), and this is considered desirable (Thomas, 1980). Thus far, no significant differences have been observed on this scale when giving the survey at the beginning and end of the semester. However, research has shown that students' attitudes are context-dependent, and the questions posed in an everyday nonscience context on the Rotter survey may not accurately reflect students' attitudes in a science class (Hofer & Pintrich, 1997). It may be necessary to use other surveys that pose similar questions in a science context such as the Epistemological Beliefs Assessment for Physical Science (Elby, n.d.).

Adaptability of the Course Model

Although the topic of this chapter has been a science course, there is no reason why many of its techniques and philosophies could not be implemented in other courses as well. Evidence-based reasoning, regardless of whether that evidence is a laboratory experiment, the events of history, market data, or the writings of an author, is the cornerstone of practice in all fields. With the increasing popularity of problem-based and case-based learning, resources abound to help instructors in all fields incorporate activities designed to help students practice thinking and reasoning skills into their classes (Rhem, 1998). Such activities can also give students a better understanding of what it means to work in a given field than simply reading about it from a textbook. Similarly, the activities designed to help students reflect on their learning and improve their metacognitive abilities through journal writing could be adapted to any class without much modification.

The most difficult part of the course to adapt, especially to large classes, is the interactive aspect in which students discuss ideas with their peers. However, such interaction is becoming increasingly valued in science classes of all types and techniques have been developed for fostering peer interaction in large lecture classes. For example, Mazur (1997) and Adams and Slater (2002) discussed how they implemented group activities in their 200-student classes.

Summary

Science courses can play an important role in a developmental education curriculum by providing a content course for developing students' reasoning and metacognitive skills. Although the emphasis I have chosen to place on such skills means that my course cannot address as many different topics as a "mile-wide, inch-deep" survey course for nonscience majors, I think that ultimately, my students are better served by practicing critical reasoning skills they can apply outside of science, experiencing the process of doing science by constructing theories based on experimental evidence to explain and predict real-world phenomena, and reflecting on the different activities in which they engage to learn new knowledge. These are skills that should serve them well not only in their future college courses, but in their life beyond their formal education.

References

Adams, D. L. (1993). Instructional techniques for critical thinking and life-long learning in science courses. *Journal of College Science Teaching, 23,* 100–104.

Adams, J., & Slater, T. (2002). Learning through sharing: Supplementing the astronomy lecture with collaborative-learning group activities. *Journal of College Science Teaching, 31*, 384–387.

Anderson, J. R., Greeno, J. G., Reder, L. M., & Simon, H. A. (2000). Perspectives on learning, thinking, and activity. *Educational Researcher, 29*(4), 11–13.

Arenson, K. W. (1998, May 7). Pataki-Giuliani plan would curb CUNY colleges' remedial work. *New York Times,* p. A1.

Arons, A. B. (1990). *A guide to introductory physics teaching*. New York: Wiley.

Astin, A. W. (1993). *What matters in college: Four critical years revisited*. San Francisco: Jossey-Bass.

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives: The classification of educational goals*. New York: Longman, Green.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 17*(1), 32–42.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65,* 245–281.

Carey, S. (1986). Cognitive science and science education. *American Psychologist, 41*, 1123–1130.

Cobb, P., & Bowers, J. (1999). Cognitive and situated learning perspectives in theory and practice. *Educational Researcher, 28*(2), 4–15.

Coffman, S. (1991). Improving your teaching through small-group diagnosis. *College Teaching, 39*, 80–82.

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making things visible. *American Educator, 15*(3), 6–11, 38–46.

Cooper, J. L., & Mueck, R. (1990). Student involvement in learning: Cooperative learning and college instruction. *Journal on Excellence in College Teaching, 1*, 68–76.

Dykstra, D. I., Boyle, C. F., & Monarch, I. A. (1992). Studying conceptual change in learning physics. *Science Education, 76,* 615–652.

Elby, A. (n.d.). The idea behind EBAPS. Retrieved June 7, 2004, from http://www2.physics.umd.edu/~elby/EBAPS/idea.htm

Eliason, J. L. (1996). Using paradoxes to teach critical thinking in science. *Journal of College Science Teaching, 15,* 341–344.

Farnham-Diggory, S. (1992). *Cognitive processes in education* (2nd ed.). New York: Harper Collins.

Fullilove, R. E., & Treisman, P. U. (1990). Mathematics achievement among African American undergraduates at the University of California, Berkeley: An evaluation of the mathematics workshop program. *Journal of Negro Education, 59,* 463–478.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics, 66,* 64–74.

Halloun, I. A, & Hestenes, D. (1985). Common sense concepts about motion. *American Journal of Physics, 53,* 1056–1065.

Hammer, D. (1994). Epistemological beliefs in introductory physics. *Cognition and Instruction, 12,* 151–183.

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. Part 1: Groups versus individual problem solving. *American Journal of Physics, 60*, 627–636.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67,* 88–140.

Hogan, K. (1999). Thinking aloud together: A test of an intervention to foster students' collaborative scientific reasoning. *Journal of Research in Science Teaching, 36,* 1085–1109.

Irving, C. (1995). A line in the sand. *Crosstalk, 3*(3), 20.

Johnson, D. W., Johnson, R., & Anderson, D. (1983). Social interdependence and classroom climate. *Journal of Psychology, 114*, 135–142.

Johnson, D. W., Johnson, R., & Smith, K. (1998). *Active learning: Cooperation in the college classroom.* Edina, MN: Interaction.

Lawson, A. E. (1978). The development and validation of a classroom test of formal reasoning. *Journal of Research in Science Teaching, 15,* 11–24.

Lawson, A. E. (1985). A review of research on formal reasoning and science teaching. *Journal of Research in Science Teaching, 22,* 569–618.

Mazur, E. (1997). *Peer instruction: A user's manual*. Upper Saddle River, NJ: Prentice-Hall.

McCloskey, M. (1983). Naïve theories of motion. In D. Gentner & A. Stevens (Eds.), *Mental models* (pp. 229–324). Hillsdale, NJ: Erlbaum.

McDermott, L. C., & Physics Education Group. (1996). *Physics by inquiry: An introduction to physics & the physical sciences.* New York: Wiley.

McDermott, L. C., & Shaffer, P. S. (1993). Research as a guide for curriculum development: An example from introductory electricity. Part I. Investigation of student understanding. *American Journal of Physics, 60,* 994–1003; erratum (1993), *61*, 81.

Paul, R., & Elder, L. (2004). Critical thinking . . . and the art of close reading (Part II). *Journal of Developmental Education, 27*(3), 36–37.

Pogrow, S. (1992). A validated approach to thinking development for at-risk populations. In C. Collins & J. N. Mangieri (Eds.), *Teaching thinking: An agenda for the 21st century* (pp. 87–101). Hillsdale, NJ: Erlbaum.

Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education, 66,* 211–227.

Rhem, J. (1998). Problem-based learning: An introduction. *National Teaching & Learning Forum, 8*(1), 1–4.

Rosenquist, M. L. (1982). *Improving preparation for college physics of minority students aspiring to science-related careers: Investigation of student difficulties and development of appropriate curriculum*. Unpublished doctoral dissertation, University of Washington, Seattle.

Roth, W. M., & Roychoudhury, A. (1994). Physics students' epistemologies and views about knowing and learning. *Journal of Research in Science Teaching, 31,* 5–30.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80* (Whole No. 609).

Rotter, J. B. (1990). Internal versus external control of reinforcement: A case history of a variable. *American Psychologist, 45,* 489–493.

Ryan, A. G., & Aikenhead, G. S. (1992). Students' preconceptions about the epistemology of science. *Science Education, 76,* 559–580.

Scherr, R. (2003). An implementation of Physics by Inquiry in a large-enrollment class. *Physics Teacher, 41*, 113–118.

Shaffer, P. S., & McDermott, L. C. (1993). Research as a guide for curriculum development: An example from introductory electricity. Part II. Design of an instructional strategy. *American Journal of Physics, 60*, 1003–1013.

Slavin, R. (1983). *Cooperative learning.* New York: Longman.

Stahl, N. A., Simpson, M. L., & Hayes, C. G. (1992). Ten recommendations from research for teaching high-risk college students. *Journal of Developmental Education, 16*(1), 2–4, 6, 8, 10.

Thomas, J. (1980). Agency and achievement: Self-management and self-regard. *Review of Educational Research, 50,* 213–241.

Wessel, D. (1998, November 9). Who will teach Johnny to read? *Wall Street Journal* (Eastern edition), p. A1.

Zimmerman, C. (2000). The development of scientific reasoning skills. *Developmental Review, 20*(1), 99–149.

CHAPTER 18

Reading, Writing, and Sociology? Developmental Education and the Sociological Imagination

Heidi Lasley Barajas and Walter R. Jacobs

ABSTRACT

Disciplines such as sociology have not traditionally participated in the developmental education field. Our experience as sociologists working with developmental education professional associations and educators found a particular focus on the three basic skill areas of reading, writing, and mathematics. Beyond identifying sociology as a discipline not manifestly concerned with developmental issues, we have noted that entering the developmental education field has been challenging because a limited focus on reading, writing, and math as skills rather than as disciplines has historically tied the field to a definition of *who* is developmental. However, developmental education is now also concerned with the generation of discipline-specific learning strategies that support the academic progress of all postsecondary learners, at all levels of the learning continuum. This chapter uses the sociology-specific learning strategies of "Universal Design for Learning" and "the sociological imagination" to provide general developmental opportunities and address a wide range of access issues.

Developmental educators have to make choices about teaching. In fact, we often spend research as well as teaching time making choices about teaching. No matter where we are teaching, in a large urban setting, in rural areas, or in suburbia, we often make choices that attempt to meet the needs of a variety of student learners as well as support the particular theoretical and philosophical approach we bring to the classroom. However, our experience as sociologists working with developmental education professional associations and educators found a particular focus on the three basic skill areas of reading, writing, and mathematics. In addition, we have experienced some surprise on the part of both developmental education associations and educators that disciplines other than reading, writing, and mathematics are developmental in nature. Why would this be?

There are three obvious answers to this question. First, developmental education historically is based in a theoretical foundation that promoted skill building by assessing individual students' skill deficiencies in reading, writing, and mathematics. Even with recent attempts by the National Association for Developmental Education (NADE; 1995) to reexamine the definition and guiding principles of developmental education, Lundell and Collins (1999) asserted that

> as a profession, we operate from an assumption that students or their home environments must be "fixed," that the students served in our programs or their families or their neighborhood are in some way pathological when seen against an imagined "healthy" norm. (p. 6)

In other words, we are tied to a historic definition of *who* is developmental. However, if we were to look seriously at the overall deficiency of students, regardless of their status as participants in developmental programs, our assessment might be a lack of critical thinking skills in all academic areas, something lacking in the majority of students in higher education. Such an observation seriously challenges a focus on the individual student, particularly when not limited to three academic areas.

Second, developmental educators may not think beyond the three basic skill areas because as an academic focus other disciplines such as sociology have not traditionally participated in or attempted to broaden the developmental field. Although sociologists may have assembled courses that are "developmental" in nature—that is to say, courses that develop thinking and learning skills—they may not think of it in those terms. Mainstream sociology is concerned more with explaining the abstract forces that structure students' lives rather than developing students' individual skills in negotiating these powerful forces.

Third, higher education tends to link the educational needs of diverse student groups to additive "remedies" that, in general, do little to assuage the needs of diverse students (Moore, 2002). Although relatively new in application to higher education classrooms, an alternative to additive remedies does exist. Some of the most dynamic ideas about the relationship of student learning and the curriculum appear in the research and application of Universal Instructional Design (Silver, Bourke, & Strehorn, 1998). Universal Instructional Design (UID) emerged from the architectural concept "universal design" that emphasizes meeting the accessibility needs of people with disabilities in both public and private spaces by developing "comprehensive plans that would be attractive to all the individuals who use that space" (p. 47). In like manner, Silver et al. stated that universal design strategies also apply to the development of postsecondary instructional design accommodations formally set aside for students with a variety of disabilities. Rather than focusing on modifying instructional approaches on a case-by-case basis, UID encourages instructors to concentrate on developing instructional strategies that "most students can use to gain knowledge and skills related to the specific content areas" (p. 48). In other words, UID suggests accessibility issues are an integral part of instructional development, and accessibility benefits multiple students in multiple ways.

The problem for diverse student groups is that an assumed element of educational spaces is neutrality (Barajas, 2000, 2002; Eliasoph, 1999; Feagin, Vera, & Imani, 1996; Moore, 2002). Therefore, the current "universal" design of the classroom is normalized in terms of race, class, gender, language, and physical ability to mean middle-class, White, male, English speaking, with no physical or psychological challenges. For this reason, the definition of UID, in most cases applied to students with disabilities, benefits from the expanded concept presented by the Center for Applied Special Technology (CAST) definition of universal design for learning (UDL):

> The central practical premise of UDL is that a curriculum should include alternatives to make it accessible and appropriate for individuals with different backgrounds, learning styles, abilities, and disabilities in widely varied learning contexts. The "universal" in universal design does not imply one optimal solution for everyone. Rather, it reflects an awareness of the unique nature of each learner and the need to accommodate differences, creating learning experiences that suit the learner and maximize his or her ability to progress.

This definition of universal design is more inclusive than previous definitions that focus on only those with disabilities. The accommodation of "differences" takes on an expanded meaning allowing us to consider other kinds of differences, such as race, class, and gender differences that have traditionally suffered in terms of access issues (Barajas & Higbee, 2003). How, then, can the premise of UDL facilitate expanding our understanding and application of developmental education?

As often happens in our attempts to expand our research and practices, we tend to look for the theoretical holes in existing definitions and practices. However, a review of the "Definition and Goals Statement" (1995) created by the National Association for Developmental Education also reveals similarities in the definition of UDL and the definition of developmental education. For example, principles within the NADE definition may also be useful to consider in the evolution of sociology as a developmental course.

> Developmental Education is a field of practice and research within higher education with a theoretical foundation in developmental psychology and learning theory. It promotes cognitive and affective growth of all post-secondary learn-

> ers, at all levels of the learning continuum. Developmental Education is sensitive and responsive to the individual differences and special needs among learners. Developmental Education programs and services commonly address preparedness, diagnostic assessment and placement, affective barriers to learning, and development of general and discipline-specific learning strategies.

The similarities between UDL and developmental education principles are important. Both address postsecondary learning needs. Both promote responsibility to all postsecondary learners. Both advocate attention to discipline-specific learning as well as general learning. Some tensions also exist when considering the specifics of NADE principles and the more universal approach of UDL. For example, NADE grounds the practice and research of developmental education in developmental psychology, which could be perceived as a tension when integrating developmental concepts into disciplines such as sociology. Sociology was established as a discipline because it identified influences external to the individual as fundamental in understanding individual behavior. However, it is this very point that requires consideration in the integration of sociology, developmental education, universal learning design, and a diverse student population.

Sociology as Developmental, Universally-Designed Instruction

As instructors in the discipline of sociology, we know that we develop our courses through the curriculum we teach, the choice of materials, and the order and focus of the goals and objectives. We also develop our courses in terms of how we present the material and consider what kinds of experiences with the material will most significantly provoke student learning. Specifically, we strive to develop students' ability to connect abstract concepts with observable phenomena. We do this for a specific reason: our goal, as Bourdieu (1993) suggested, is to keep people from uttering all kinds of nonsense about the social world. To accomplish this goal, students must push through their taken-for-granted, common-sense ideas about the social world to reveal the history that makes the social world function in particular ways, and the processes that sustain or challenge those functions. However, connecting the abstract to the empirical is a skill that is developed, and one that can be developed simultaneously with reading and writing skills. We approach this developmental method through C. Wright Mills' (1967) concept of "the sociological imagination."

Mills framed the sociological imagination in the notion that people, when considering their personal troubles, seldom look to explanations outside of the individual. According to Mills, individual social actors rarely connect what is happening in an individual life to history, historical change, and institutions within society. As Mills (1967) stated:

> The sociological imagination enables its possessor to understand the larger historical scene in terms of its meaning for the inner life and the external career of a variety of individuals. It enables him [or her] to take into account how individuals, in the welter of their daily experience, often become falsely conscious of their social positions. Within that welter, the framework of modern society is sought, and within that framework the psychologies of a variety of men and women are formulated. By such means the personal uneasiness of individuals is focused upon explicit troubles and the indifference of publics is transformed into involvement with the public issues. . . . The sociological imagination enables us to grasp history and biography and the relations between the two within society. (pp. 5–6)

Constructing a course based in the sociological imagination is more than a "best practices" phenomenon. It requires understanding the theoretical implications of treating all students as developing sociologists, able to identify their own social location in a historical as well as biographical context. Two assumptions are readily apparent in grounding student learning in the framework of the sociological imagination. First is Mill's assumption that individual social actors rarely consider that to "grasp what is going on in the world, and to understand what is happening in themselves" (p. 7) is in large part the intersection of biography and the formative power of history. Second is that differences in student cultural capital become less hierarchical, leaving the impression of diversity rather than deficiency of a cultural norm. Cultural capital, according to Bourdieu (1993), referred to the specific skills and competencies, such as the ability to use language, that middle- and upper-class parents are able to pass on to their children. Combined with economic capital, the possession of cultural capital provides advantages to members of the middle and upper classes, increasing the probability that they will succeed in maintaining or increasing social status and rewards. When students gain a sociological imagination, they learn that the possession of social status and rewards is not "natural," or gained merely through individual hard work and effort, but it is either constrained or facilitated by social group membership.

Constructing a course based in the sociological imagination allows students to make more expansive and critical "articulations," which are discursive connections of personal troubles and societal issues that serve particular interests and powers (Slack, 1996). These connections are social constructions created through discourse, therefore they can be broken through discourse and replaced with different understandings:

> With and through articulation, we engage the concrete in order to change it. . . . articulation, then, is not just a thing (not just a connection), but a process of creating connections, much in the same way that hegemony is not domination but the process of creating and maintaining consensus of co-ordinating interests. (Slack, p. 114)

This process is especially important in classes with students from diverse backgrounds. Not only does this process place more articulations in the air, but the illustration of how some articulations are embraced while others are ignored can lead to powerful teaching moments in the development of the sociological imagination. Such a process also addresses the problematic practice of developmental education stressed by Lundell and Collins (1999). Articulations created in the development of the sociological imagination may generate a teacher-learner, learner-teacher format envisioned by Freire (1970), where all members of the learning community are receiving and providing valuable knowledge. Accordingly, instructors as well as students learn to question the historic definition of *who* is developmental and what process creates and maintains interests in attaching an individual deficit meaning to the developmental concept rather than understanding developmental as something that "promotes cognitive and affective growth of all post-secondary learners, at all levels of the learning continuum" (NADE, 1995). Creating a teaching space in terms of both curriculum and pedagogy that promotes multiple articulations necessitates expanding and integrating the use of developmental education principles and the principles of Universal Instructional Design. Developmental education is less about the deficiency of particular individuals and more about promoting the growth of all postsecondary learners and whatever "preparedness" issues students face. We also need to change our definition of universal, beginning with the idea that "centering our classroom activities and requirements around what we used to consider 'special needs' students in reality creates a classroom that simply promotes student centered learning for all students" (Barajas, 2002).

Service Learning and the Sociological Imagination

For Barajas, the most effective way of teaching college students the realities of the social world is to read classical and current interpretations of the social world, and to compare what they read to what they observe while performing community service. Combining these two approaches is beneficial, but may not have the developmental importance believed to exist if not performed within the framework of the sociological imagination. Current research in the area of service learning indicates that overall, service learning has a positive effect on student development (Astin & Sax, 1998; Driscoll, Holland, & Gelman, 1996; Dunlap, 1998). Overall, mostly survey research about service learning has been collected and analyzed, but little has directly addressed the possibility that diverse student groups experience service learning differently. Of the few qualitative studies conducted, a research method more likely to describe the *process* of student development involved in service learning, they tend to be about White, often middle-class students entering service sites where the population is considered disadvantaged and has a large racial and ethnic minority population (Dunlap). Although important research in itself, the research traces personal development of White student attitudes about larger social issues, interpretations of how these students regarded specific race-related, gendered, or classed incidents, and how the experience affected their view of the larger social world. What this literature does not do, however, is examine or at times even acknowledge the differences among students. Working class or poor students of color, for example, unlike their White, middle-class peers appearing in much of the literature, may experience the service learning site as an outsider, as a member of the community, or as a community site very much like their original community. In other words, although most often considered an alternative to conventional classroom routines, service learning often assumes a position of neutrality, a normative classroom practice through which students respond to the larger social world without considering how their own biography may affect their observations and analyses. If, on the other hand, service learning is approached through the framework of the sociological imagination, it may serve as a theoretical space for students to see connections between personal troubles and social issues, the biography of the individual, and history of the social world.

Two examples from student final paper projects in a sociology course taught by Barajas highlight how students come to understand social issues when perceived through the sociological imagination. Student names have been changed to maintain confidentiality. Both students are freshmen but differ in other social characteristics such as race, ethnicity, social class, and gender. As the course progressed, the students self-identified race, ethnicity, and social class, building their own biographies according to sociological definitions of these social characteristics.

Tom, an 18-year-old White, middle-class male, discussed gender inequity in education in his final paper. His conclusion stated:

> I have always felt that as a White male, I am blamed for any unequal treatment others received. It especially bugged me to hear that girls are treated unfairly in school because I always thought girls were treated better than boys. Because of my personal experience, I was not convinced when I read Sadker and Sadker's (2002) article that said daily classroom interactions showed girls don't receive their fair share of education. Two things changed my mind. After

> spending a semester in an [elementary] after-school program, and observing like a sociologist, I watched girls get crowded out of gym space, told they couldn't play ball with the boys, talked over, and ignored in the classroom activities. And nobody did anything about it, because nobody noticed it. This is the second thing that changed my mind. The fact that no one notices gender bias when it is there is about institutional sexism. This means that it is not about individual people being prejudice, it is about how the institution reinforces social inequality by making girls think they are worth less. This is a social issue, not just a personal trouble.

Like many students in higher education, particularly mainstream students, Tom was reluctant to think of other life experiences as different from his own. Tom is a fairly typical example of a student who, in trying to understand the realities of the social world, such as the existence of gender inequality, does not necessarily learn to think critically from reading and analyzing scholarly research. Even adding personal experience such as service learning would not necessarily push Tom to change the discourse surrounding his understanding of gender issues. However, identifying and integrating his own history with that of the institution, combined with the opportunity to observe through the lens of personal trouble and social issue, allowed Tom to observe differently than he may have without the framework of the sociological imagination.

Gender issues looked different to Kim, a Hmong female who performed service learning in her own community. Kim participated in a national after-school reading program for third graders. Although performing duties defined as "tutoring," Kim also saw herself as a mentor to other young Hmong females. Her final paper stated:

> I want to bring back to my Hmong community the fact that education is a step forward in our culture [for girls]. . . . I think it is important for me to do service in the Hmong community because these girls don't see a lot of older Hmong girls going on to higher education. I am glad I go to this school [to do service learning], and am pretty sure they are glad I go there too. This is because of my personal social location and an understanding of the larger social issues. . . . I feel that I am a role model because I have made it this far. Not only as a role model for my family, but for my Hmong community as well. Statistics show that many Hmong girls, when they marry drop out of school and never go to college. Many may view this as an individual trouble because Hmong girls choose to marry young. However, this is also a social issue having to do with cultural differences, and the lack of multicultural education in educational institutions. In my high school, the majority of Hmong girls were married. In our culture, it is normal to be married and even have children around the age of 15 and 16. What was sad and difficult was that people at school teased them and made fun of them. Hmong girls lived their original culture gender norms, and not the White, middle-class, gender norms of the insti-

> tution. Consequently, they did not feel they belonged in school. This is ethnocentrism, and therefore a social issue affecting Hmong girls.

In both of these examples, the use of the sociological imagination creates the space for articulations. Moreover, these articulations highlight developmental issues for students, including some "preparedness" issues that are connected to critical thinking skills we may not have observed with a more narrow definition of developmental education, especially one that does not "advocate attention to discipline-specific learning" (NADE, 1995). However, the articulations are specific because they integrate each student's own history with that of the institution. Both students had the opportunity to observe through the perspectives of personal trouble and social issues. This process allowed Tom to observe the reality of gender stratification. Kim also observed gender stratification, but she observed it through the lens of cultural differences. In other words, the process allows different articulations specific to the development of sociological learning in each student despite very different social characteristics and learning needs.

Performing the Sociological Imagination

Sociology instructors also have a variety of non-service-learning-based pedagogical strategies they can use to encourage students to develop their sociological imaginations and produce more complex articulations. A centerpiece of Jacobs' classes, for instance, is "The Educational Storytelling Project" (ESP), in which students create and share stories about "ghosts" of a social versus paranormal kind, the strong but usually unconscious forces that shape our everyday lives. These stories are developed through "intertextual" dialogue: students are required to reference each others' stories and discuss their educational experiences throughout the story writing and telling process. Specifically, each student (a) writes a short ghost story, (b) reads it orally in a small group, and (c) writes a reflection on another student's story and performance. Students also have the option of presenting their ESP story to the entire class. Finally, the class collectively analyzes the project in an instructor-led discussion.

Some students tell autobiographical narratives, while others tell stories about other people, both factual and fictional. All, however, are involved in an investigation of the complex interplay between social privilege and disadvantage, and they explore the development of certain articulations and the implications of accepting these articulations and not others. Gordon (1997) argued:

> to write stories concerning exclusions and invisibilities is to write ghost stories. To write ghost stories implies that ghosts are real, that is to say, that they produce

> material effects. To impute a kind of objectivity to ghosts implies that, from certain standpoints, the dialectics of visibility and invisibility involve a constant negotiation between what can be seen and what is in the shadows. (p. 17)

Many students, for example, do not understand the connection of language and power; that is, we often unconsciously use certain words or phrases to stigmatize groups to prevent them from obtaining full societal acceptance and participation. For instance, students will use the phrase "that's gay" to signal disapproval or dislike. One student, John, came out in one of Jacobs' classes as a gay man in his ESP performance to the entire class, centering on the pain he feels when reminded about marginalization. In his reflection John noted,

> When each of us is pulled apart for some factor that we have no control over, it makes us debate many things, including how valuable we are as people. From writing stories like these people have to think how deep they would like to go in their writing, and what may be too personal for the reader versus what might be too personal for the writer to talk about. In my ESP story, I thought a lot about what I've learned from being a homosexual male, and tried to talk about my schooling, and the many ways and things I learned throughout because of it.

John went on to talk about how he wanted his ESP story explicitly to raise awareness about issues of difference specifically related to sexual orientation. As discussed in the previous section on service learning, many students are reluctant to consider life experiences of those different from themselves. They will often grudgingly read assigned articles about various minority groups, and only a few will participate in class discussion; usually these students are members of the topic group. The ESP provides another framework in which students can get outside of themselves. In reflection papers several students commented on John's coming-out experience. One student wrote, "this ESP project allowed me to look into myself and find socializing agents that make me who I am today. And, it also caused me to gain a newfound respect for gays and lesbians." Another believed,

> Thinking about social ghosts makes me want to be more understanding. I have so many social ghosts that it makes me sure that everyone has at least a few that effect them all the time. I think it would be good for everyone to realize that everyone has these issues and to be aware of them and treat people accordingly.

In other words, students gain an understanding of stigma and its effects, which may be especially important for developmental education students. Pedelty (2001) argued that many students participating in developmental education feel stigmatized as learners and that their peers hold negative perceptions about them and their academic programs. Among other things, they are labeled as "slow" or "dumb" and "not real students." Using their own stigmas as springboards to connections with larger social forces can help students see themselves as valuable members of the academic community. As Fingerson and Culley (2001) stated,

> If students see another undergraduate participating in the responsibility of transmitting and communicating knowledge, this can demonstrate the capacity of undergraduates to actively participate in this process and break down the notion that only an "expert" faculty member has anything worthwhile to contribute to the class. (p. 311)

Indeed, the use of tools such as the ESP and service learning courses encourages all students to take more responsibility for their learning and help each other create powerful learning strategies.

Conclusion

There are many similarities between the guidelines for universally-designed sociology courses and developmental education: both address postsecondary learning needs, promote responsibility to all postsecondary learners, and advocate attention to discipline-specific learning as well as general learning. The task we have encountered as sociologists building on a developmental education framework required discipline-specific strategies that integrate and expand existing developmental principles. In addition, as critical sociologists, we wanted to emphasize the positive role the institution can play by recognizing the value of differing experiences, particularly differences that have been historically labeled as deficits by the institution. Learning and utilizing the sociological imagination allows both students and instructors to bring a wide variety of skills, knowledge, and experiences to the academy, above and beyond institutional mandates about students who have traditionally been placed in developmental education programs that are located on the periphery of postsecondary education. The sociological imagination as a theoretical concept teaches us that a UDL sociology course is one in which one size does *not* fit all; it should make room for flexible, customizable content, assignments, and activities that are accessible and applicable to students with a variety of backgrounds, learning styles, abilities, and disabilities. In addition, by viewing practices such as service learning and the ESP through a sociological imagination lens, we create an awareness and active engagement with what students bring to academic spaces. This not only facilitates their successful negotiation of academic careers, but it also enhances their ability to succeed in nonacademic endeavors.

In UDL sociology courses supported by the sociological imagination, students do not learn just one set of assumptions. They learn to negotiate multiple—and often conflicting—sets of experiences and behaviors, evaluating which set is the most fruitful in a given context. Students develop specific skills that help them construct and demonstrate learning processes such as making strategic plans, seeking and evaluating reasons, creating intellectual curiosity and wonder, and sharpening metacognition. Students and teachers alike engage in continual dialogue and action on a never-ending quest to develop themselves as individuals, members of social groups, and actors on a host of institutional stages. UDL sociology courses, then, may be as fundamental to developmental education as reading, writing, and mathematics.

There is no question that what we are presenting in this chapter represents a first step in approaching developmental education as a sociological endeavor. What we suggest in addressing multiple aspects of the developmental education picture at one time is that exploring what educators, institutions, and professional organizations do to increase the educational opportunities for students is more complex than addressing how "developmental students" need to be fixed. To invite a more complex approach, we suggest that further investigation and possible integration of these complex ideas into all developmental education curricula should be explored by a variety of discipline-specific developmental educators. We are by no means suggesting we throw out the proverbial "baby with the bathwater." We acknowledge the work of developmental education but hope to extend the educational support and access for diverse student groups by integrating sociological ideas.

References

Astin, A., & Sax, L. (1998). How undergraduates are affected by service participation. *Journal of College Student Development, 39* (1), 251–263.

Barajas, H. L. (2000). Is developmental education a racial project? Considering race relations in developmental education spaces. In D. B. Lundell & J. L. Higbee (Eds.), *Theoretical perspectives for developmental education* (pp. 29–37). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Barajas, H. L. (2002). Changing objects to subjects: Transgressing normative service learning approaches. In D. B. Lundell & J. L. Higbee (Eds.), *Exploring urban literacy and developmental education* (pp. 25–32). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Barajas, H. L., & Higbee, J. L. (2003). Where do we go from here? Universal Design as a model for multicultural education. In J. L. Higbee (Ed.), *Curriculum transformation and disability: Implementing Universal Design in* *higher education* (pp. 285–292). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

Barajas, H. L., & Pierce, J. L. (2001). The significance of race and gender in school success for Latinos and Latinas in college. *Gender & Society, 15*, 859–878.

Bourdieu, P. (1993). *Sociology in question*. London: Sage.

Center for Applied Special Technology. (2001). *Summary of Universal Design for learning concepts*. Retrieved January 28, 2002, from http://www.cast.org

Driscoll, A., Holland, B., & Gelman, S. (1996). An assessment model for service learning: Comprehensive case studies of impact on faculty, students, community and institution. *Michigan Journal of Community Service Learning, 3*, 66–71.

Dunlap, M. (1998). Methods of supporting students' critical reflection in courses incorporating service learning. *Teaching of Psychology, 25*, 208–210.

Eliasoph, N. (1999). Everyday racism in a culture of political avoidance: Civic society, speech and taboos. *Social Problems, 46*, 479–502.

Feagin, J., Vera, H., & Imani, N. (1996). Confronting White students: The Whiteness of university spaces. In J. Feagin (Ed.), *The agony of education* (pp. 89–116). New York: Routledge.

Fingerson, L., & Culley, A. B. (2001). Collaborators in learning: Undergraduate teaching assistants in the classroom. *Teaching Sociology, 29*, 299–315.

Freire, P. (1970). *Pedagogy of the oppressed.* New York: Seabury.

Gordon, A. (1997). *Ghostly matters: Haunting and the sociological imagination*. Minneapolis, MN: University of Minnesota Press.

Lundell, D. B., & Collins, T. (1999). Toward a theory of developmental education: The centrality of "Discourse." In J. L. Higbee & P. L. Dwinell (Eds.), *The expanding role of developmental education* (pp. 3–20). Morrow, GA: National Association for Developmental Education.

Mills, C. W. (1967). *The sociological imagination*. London: Oxford University.

Moore, R. (2002). The lessons of history: Transforming science to include developmental education. In D. B. Lundell & J. L. Higbee (Eds.), *Histories of developmental education* (pp. 83–92). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, General College, University of Minnesota.

National Association for Developmental Education. (1995). *Definition and goals statement.* Carol Stream, IL: Author

Pedelty, M. H. (2001). Stigma. In J. L. Higbee (Ed.), *2001: A developmental odyssey* (pp. 53–70). Warrensburg, MO: National Association for Developmental Education.

Sadker, M., & Sadker, D. (2002). Failing at fairness: Hidden lessons. In S. J. Ferguson (Ed.), *Mapping the social landscape: Readings in sociology* (pp. 583–596). Boston: McGraw-Hill.

Silver, P., Bourke, A., & Strehorn, C. (1998). Universal Instructional Design in higher education: An approach for inclusion. *Equity & Excellence in Education, 31* (2), 47–51.

Slack, J. (1996). The theory and method of articulation in cultural studies. In D. Morley & K. H. Chen (Eds.), *Stuart Hall: Critical dialogues in cultural studies* (pp. 112–127). New York: Routledge.