

A Tale of Two Disciplines: A Community College/Public School Writing Collaborative

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Abstract

The three-year National Science Foundation project titled Transactional Writing: Empowering Women and Girls to Win at Mathematics gave fourteen mathematics and English teachers on the college and middle school levels the opportunity to work collaboratively in the application of transactional writing—writing used to develop, construct, and express mathematical understanding. Miami-Dade Community College (M-DCC) is a large, urban two-year college in Miami-Dade County, Florida. The college consists of six main campuses and several outreach centers. The Miami-Dade County Public Schools (M-DCPS) is a large, urban school system in Miami-Dade County, Florida. The participants were in five different groups of students in the basic mathematics, introductory algebra, intermediate algebra, general college mathematics, and college algebra sequences, as well as groups of students in a one-, two-, or three-year middle school mathematics sequence. The objective was to determine whether combining communication skills with mathematical skills had a positive effect on students' achievement and attitude.

Outside my math department office are shelves holding sheets that describe the requirements of the various degree and certificate programs that the college offers. I pass these shelves many times each day. Often, I hear students deciding to opt out of particular careers because they believe that there's "too much math" involved. On these occasions, I think to myself, "Perhaps (s)he is missing (her) his calling." I can either be a part of the problem or a part of the solution. I have chosen the latter.

The three-year National Science Foundation project titled "Transactional Writing: Empowering Women and Girls to Win at Mathematics" introduced students to transactional writing—writing used to develop, construct, and express mathematical understanding. Divided into five different groups, students utilized transactional writing methods in basic mathematics/introductory algebra, intermediate algebra, general college mathematics, and college algebra sequences, as well as in groups of participants in a one-, two-, or three-year middle school mathematics sequence. The objective was to determine whether the combining of communication skills with

mathematical skills had a positive effect on students' achievement and attitude. Pretest and posttest data was collected on experimental groups (writers) and control groups (nonwriters) each year.

Teams of mathematics and English faculty investigators and their students from Miami-Dade Community College—Kendall and Cutler Ridge, Glades, and Southwood Middle Schools (Miami-Dade County Public Schools, Miami, Florida) created a project-based academic writing community. Experimental groups at each level received whole class instruction, including transactional writing exercises. At each level, the control group received whole class instruction without the transactional writing exercises.

Charles Hyser of Augustana College (Rock Island, Illinois) asks, "What is it about our culture that is creating a fear of math in young women?" The paths to advanced levels of mathematics, and hence employment opportunities, are hindered often by powerful institutional influences that discourage females from studying math. These influences include assessment and instructional practices that may lead to math avoidance. Since women, especially minority women, continue to be underrepresented in male-dominated occupations, this math avoidance may very well contribute to the inability of many women and minorities to reach higher income levels. Two critical points hinder females from staying with and succeeding at mathematics and thus successfully pursuing mathematics-based careers and reaching higher income levels—lack of achievement and poor attitude.

Included as one of its seven Teaching/Learning Values, Miami-Dade Community College values "change to meet educational needs and to improve learning" (*Miami-Dade Community College Catalog 1998–1999*, 6). In addition, the components of the project are congruent with the mission of the college, which is to provide a high-quality education where the learner's needs are at the center of decision-making enhanced by working in partnership with our dynamic, multicultural community.

At the heart of the project is a cooperative effort between administrators and faculties, a collaborative effort between college and middle school levels of mathematics education, and an interdisciplinary effort to meet the needs of (female) mathematics students on both of these levels. As a component of the mission statement of the college, Miami-Dade Community College is committed to articulation with collaborating institutions (higher and lower divisions). Through this project, the college continued to address persons in the service area, in this case the lower division, in a unique and innovative way.

Mathematics competency, quality writing, and gender equity are also concerns. Deficiencies and inequities in these areas are evidenced by scores on components of the College Placement Test (MAPS), the College-Level Academic Skills Test (CLAST), the Stanford Achievement Test, and the Florida Writes! examination. The collaborative efforts of mathematics and English teachers, and their administrators committed to the project well before its implementation, have not only improved student competency and equity, but will support continuation of this project after the funding period.

The faculty on the college team (three members of the mathematics faculty—the principal investigator and two co-principal investigators—and two members of the English faculty) were selected from interested and qualified mathematics

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and English faculty who accepted invitations to participate extended by the principal investigator. With administrative approvals, the principal investigator and two co-principal investigators were granted release time from the traditional five classes per term. Each investigator also coordinated project efforts with the team of teachers at one of the selected middle schools. With administrative approvals, the two members of the English faculty were granted release time. One English faculty member knowledgeable of the essay component of the College-Level Academic Skills Test model was selected. Both English investigators coordinated project efforts with the English teachers at the middle schools.

The principal investigator was responsible for coordinating the design and implementation of the training component for all teams. The principal investigator acted as liaison between the appropriate Miami-Dade Community College (M-DCC)/Miami-Dade County Public Schools (M-DCPS) administrative personnel and the college/middle school teams before, during, and after implementation. The middle school and college teams provided resources and support for one another before, during, and after the life of the project.

Within a cognitive framework, what a student learns depends to a great degree on how he or she learned it in terms of active, constructive processes (*Commission on Standards for School Mathematics of the National Council of Teachers of Mathematics 1989, 5*). Zinsser (1988) claims that the best way to immerse oneself in a field and to make it one's own is to write about it. Teaching students

mathematics through writing exercises invites students to be more active and to see themselves as mathematicians (*Countryman 1993*). According to Nahrgang and Petersen (1986), “writing will provide an opportunity to formulate, organize, internalize and evaluate . . .” (461); “a variety of intellectual skills such as synthesis, interpretation, translation, analysis and evaluation” (465) will be used.

The following observations demonstrate the need for implementing such writing programs in mathematics:

1. Teachers fail to give female mathematics students ample opportunities to communicate in ways indicative of true understanding. This impedes the learning of mathematics.
2. Students, particularly females, hold unhealthy beliefs about mathematics, concerning its nature, behavior, and tasks, e.g., isolation and conceptions of self and others.

These factors influence how female students learn mathematics (*Mtewa and Garofalo 1989*). In order to begin to change some of the teacher/female student negative practices and beliefs that interfere with female students’ deeper understanding of mathematics, educators’ focus must shift from learning products to learning processes (*Mtewa and Garofalo 1989*) such as writing. Female students and their teachers will regard mathematics in a new way. Such activities focus on the thinking processes needed to arrive at answers rather than on the answer itself.

Miami-Dade Community College (M-DCC) is a large, urban two-year college in Miami-Dade County, Florida. The college consists of six main campuses. The Kendall Campus is on a 185-acre site in southwest Miami (Miami-Dade County, Florida). According to a recent demographic profile, 55 to 65 percent of the incoming students are below placement level in one or more basic skills. Among students taking courses for college credit, 62 percent reported a native language of English. The ethnic composition of the population is 35 percent White non-Hispanic, 55 percent Hispanic, and 7 percent Black non-Hispanic; 55 percent of the population is female. Enrollment patterns at M-DCC–Kendall reflect the lack of representation of women in occupations requiring mathematical or scientific knowledge. In a study of completion rates, Institutional Research, M-DCC, found that independent of the level at which they score, students have only a 50 percent chance of completing college preparatory math courses in three years. Legislation in place at the state level during the first and second years required that students unable to pass the course on the first or second attempt pay the full

cost of instruction. (This would quadruple fees.) As a result, completion of degree programs by students starting their studies at the college preparatory level is at best uncertain.

The Miami-Dade County Public Schools (M-DCPS) is a large, urban school system in Miami-Dade County, Florida. According to recent demographic profiles, approximately 51 percent of the student population is female. Among females districtwide, mathematics performance on the Stanford Achievement Test is less than or equal to that of males, beginning at grade eight. Hence, middle schools were selected as off-campus research locales. Specifically, middle schools with which M-DCC has an articulation agreement were considered. Each middle school represents a cross-section of the area's diverse ethnicity and has a female student population of approximately 50 percent.

“. . . Math avoidance may very well be perpetuating women's and minorities' inability to reach higher income levels.”

Some students resist the writing assignments due to their novelty. They mentioned “running” from math and English classes, only to “bump into” both subjects in this math class! They argue about the value of such a strategy. But as a team of trained professionals we are accustomed to swimming upstream, and we persist together! The cross-discipline environment required for the project represents a distinctive pairing of postsecondary subject areas, writing and mathematics. It is not unusual to encounter perplexed looks when explaining the possible correlation. Years of experience have created a cooperative team of practitioners sold on the intervention and its cross-discipline impact. Students who finally realize that traditional math instruction has not worked for them, they become more willing to try something different. Over time, doubters are eventually convinced of its effectiveness and begin to promote writing in the math classroom. One investigator noted, “We observed a remarkable improvement in [the developmental] students' writing. This was evident not only in their math writing assignments but in the Language Arts writing assignments as well.” Another views the writing as a “major asset [that has provided] greater insight into students' learning [and has improved] the quality of the teaching and learning environment.” We are particularly excited about contributing to the growing research in the area of pairing teachers and classes for consecutive semesters (years).

There is a stark contrast between the writing and nonwriting groups in the areas of responsiveness, preparedness, general attitude, and energy level. Upon entering the classroom, it is not unusual to happen upon a tutoring session among the writers that is peppered with the vocabulary of mathematics. The writing students seem very comfortable serving as mentors to one another during these interactions. Writers seem to observe more, ask more, and think and hypothesize more. One investigator noted, "My writing classes ask more questions and expect more answers. The writing classes need to understand why this works rather than just how."

Students shift from apprehension to appreciation: "Math is not one of my better subjects. The writing assignments have been difficult to do. How can I write on something if it is not explained in the book in a way I can understand? I do see the purpose of the writing assignments, and it has helped me to stretch my brain, and investigate to find out the right answer. Thank you for all your help. . . . The writing assignments have helped me to stretch my brain, and I need it!"

In a letter another writer, Maria, complimented her instructor for making "a wise decision because this method works very well" and said, "You can't imagine how it changed my life . . . and my grade in math, of course!" In a second letter, Maria describes her desire to introduce the project at her work site where it could continue to help others without limits. Other comments include "I want to thank you [because] I know I'm going to do well [because] . . . I know how to approach math problems [now] when I'm learning them," and "I have taken two classes with you . . . I have also completed 1102 [College Algebra]. I have so far secured all A's." In one writing class the students had just completed a test and it was being graded in class. There was lots of handshaking and high fives; students were running up to the teacher saying, "I got an A!", "I got a B!", "I got a C!" One writer said, ". . . I think I did awesome!"

On the college level, students in the writing groups were more likely to pass from college preparatory mathematics to college-level mathematics in one semester; whereas their nonwriting counterparts were more likely to repeat college preparatory course work. Overall, in college-level mathematics the writing group produced a higher percentage of passing grades (i.e., grades of A, B, or C); writers are more likely to pass. By gender, the percentage of passing grades was highest among females. On the middle school level, analyses of Stanford Achievement Test scores reveal that writers surpass nonwriters in two major components of the test, mathematics computation and mathematics applications. On both

levels, changes in attitude in the anticipated directions were observed for all groups, but were highest for writers.

As with many areas of scholarship, it has been easier to identify gender-related problems than it has been to solve them. As skilled professionals, teachers are best equipped to handle the problems that they encounter in the classroom. Empowered with new insights into these issues, they are better equipped to construct approaches that will solve these problems. Educators must explore and implement innovative ways to convince females of the vital importance of studying mathematics, and must expect that females will be successful. Teachers are key figures in motivating and encouraging females students to continue the study of mathematics. Risks must be taken and changes made before females will realize greater benefit from our teaching efforts. The report "Growing Smart: What's Working for Girls," published by the American Association of University Women (AAUW), suggests that nontraditional teaching strategies benefit females. These strategies should be based upon our desire to "celebrate [females'] strong identity . . . , ensure [females'] participation and success, and empower [females] to realize their dreams." Changing behaviors, beliefs, and attitudes *within the classroom* will enable women to become more confident and successful in mathematics, which will facilitate their pursuit of related careers. Hence, we have provided an opportunity for greater educational equity for women in nontraditional fields by implementing activities that encourage the adaptation of instructional delivery styles and classroom behaviors to the needs and concerns of students. Our research continues to confirm that this intervention offers a promise of success for females to stay with and succeed at mathematics and thus face the possibility of successfully pursuing a mathematics-based career and reaching higher income levels. This project is a way to encourage more students, both male and female, to achieve and remain in mathematics. As one investigator put it, "[The] Womenwin project [is] a part of the changing [math] classroom where the emphasis has moved from calculating to understanding. . . ."

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Suzanne Austin is a professor of mathematics at Miami-Dade Community College (Miami, Florida), and is described by her students as energetic, a bit “hyper,” and incredibly spunky. She has been encouraging and guiding students enthusiastically through the maze of self-fulfillment and self-actualization in mathematics for twenty-six years, nineteen of which have been at the Kendall campus. Her teaching career includes seven years in public schools systems in Virginia, New York, and Florida. She holds a bachelor of arts in mathematics education from George Washington University, a master’s of science in mathematics education from Nova University, and a Ph.D. in teaching and learning mathematics from the University of Miami. Eleanor Barton was born in New Orleans, Louisiana, and moved to Miami, Florida, in 1973. She is married to Charles Barton and has three wonderful sons. Her own love of baseball inspires her as she follows and supports her three baseball sons. She teaches mathematics at Glades Middle School (Miami, Florida) and is currently the president of the Killian Baseball Booster Club.