Irene M. Duranczyk
Emily Goff
Donald L. Opitz

Students' Experiences in Learning Centers: Socioeconomic Factors, Grades, and Perceptions of the Math Center

In this article, we discuss the importance, specifically for developmental educators, of understanding diverse students' use and perceptions of learning centers. Among the results of a survey of students' perceptions of the mathematics program in the General College, University of Minnesota, we found statistically significant differences in how often students from different ethnic backgrounds used the Math Center. In addition, we found differences in students' use and perceptions of the Math Center according to the students' fall semester course grades. Based on these findings, we make suggestions for learning center administration and developmental education pedagogy as well as indicate directions for future research in this area.

Research has shown that successful developmental programs provide support services such as those offered through learning centers in order to eliminate barriers to learning (Gibbs, 1994). Other research has shown that the effective delivery of learning support services such as those offered through learning centers is correlated to student success (Starks, 1989). As classroom-based de-

velopmental education programs are being marginalized and removed from publicly funded 4-year colleges and universities across the country (Caboni & Adisu, 2004), learning centers are becoming an increasingly important space in which developmental education programming is offered (Perin, 2004). While many in developmental education recognize the importance of the learning center in providing developmental education services, there is an overall paucity of research regarding *which* students are served by the peer tutoring services offered in learning centers and *how* students benefit from these services (Maxwell, 1994).

The Math Center

The Math Center at General College, University of Minnesota is a part of the Academic Resource Center, which also contains a Writing Center and Computer Center. The Math Center offers free drop-in tutoring for students from throughout the University, but serves primarily those students enrolled in developmental mathematics classes (Opitz & Hartley, 2005). A peer tutoring model has been used to provide tutorial services to students individually or in groups. In addition to these tutorial services, the Math Center is used for make-up testing, test-taking for students with documented disabilities, a reference library, and undergraduate teaching assistant training. The use of the Math Center by students is voluntary.

The Math Center administration and staff have made a proactive effort to infuse the principles and practices of multicultural education—in which individual student needs are central—into its practices. Students are encouraged and empowered to use their cultural knowledge and experiences, their intuitive language and understanding to discuss mathematics and thereby achieve a more in-depth understanding of "academic" mathematics. Assumptions about students' mathematics ability or aptitude are not made based on entry level mathematics skills. Students' prior life experiences and opportunities (cultural, social, political, educational, economic, historical, etc) impact their presentation of academic skills. The promotion of a multicultural peer tutoring philosophy is one of the central administrative and programmatic goals of the Math Center (Opitz, 2003; Opitz & Hartley, 2005). This attention to multicultural education moves beyond the celebration of diversity to providing meaningful access to students from every background (Miksch, Bruch, Higbee, Jehangir, & Lundell, 2003).

Part of this *meaningful access* is created by making the Math Center a space that is available to all students and a space where all students' different needs and expectations are respected. In order to provide this access, peer tutors in the Math Center are given clear statements

defining the many ways (respect, language, tutoring methods, choice of examples, etc.) multiculturalism is embraced in their peer tutoring handbooks and throughout their orientation (Academic Resource Center, 2003). They are also offered further coaching on multicultural education during the academic year (General College Math Center, 2003; Opitz & Hartley, 2005). This coaching takes the form of workshop activities that explore different definitions of multicultural education as well as exploring the role of peer tutors in the multicultural education mission of the Math Center (Opitz, 2003).

Student Survey

The importance of ongoing assessment in all areas of developmental education practice has been noted frequently in scholarly literature (Boylan, 1997; Trammell, 2005). Maxwell (1997) maintained that there is a positive correlation between on-going program evaluation and successful outcomes, including student retention and academic achievement. The research reported in this paper is a part of a larger attempt by the developmental mathematics program in General College to engage in longitudinal programmatic research (Duranczyk & Opitz, 2005) as recommended by Boylan (1997). This research is focused specifically on understanding students' perceptions of the mathematics tutorial program and sharing these perceptions with multiple stakeholders in order to improve services. In sharing this programmatic research with a larger community, it is hoped that it will add to the body of quantitative research regarding the peer tutoring activities of learning centers.

Method

The data for this study were gathered from a larger annual survey regarding student perception of the General College mathematics program.

Sample

Forty-nine percent of the mathematics students (360 out of a possible 740 who were enrolled in a developmental mathematics course) responded to the mathematics program survey that contained questions regarding the Math Center. This survey instrument gathered information on the overall mathematics program at General College during November of 2004. Only 324 (90%) of the surveys were usable and of those only 298 (92%) students responded to the section on the survey assessing students use and perceptions of the Math Center. Students participated on an anonymous and voluntary basis although some instructors offered students extra credit as an incentive to complete the survey. While there were student respondents from three other colleges of the university,

the great majority of the survey respondents were students enrolled in General College. Students from this college also represented the majority of students who used the Math Center (Academic Resource Center, 2003).

On the survey form, researchers allowed students to respond to an open-ended statement, "My ethnic/race identification is:". They then categorized students' responses into 8 groups: African, African American, Asian, Asian American, Indigenous Nations, Hispanic, Mixed-Race, and European American. The vast majority of respondents were categorized as European American (48%), African/African American (19%), or Asian/Asian American (20%). There were fewer than 20 students in each of the other categories, whom researchers then classified into one group as "Other" (13%). This fourth group included the heterogeneous clustering of Hispanic groups (19 students), Indigenous Nation groups (6 students), Mixed-Race groups (12 students), and other individual nations that were not clustered (5 students). The researchers recognized that the three main categories (European American, African/African American, or Asian/ Asian American) were also heterogeneous, yet conformed to standard norms for clustering racial/ethnic groups. As a result, each group included individuals from dozens of countries and individuals speaking a variety of languages at home. Parsing individuals into a more specific nation or region of origin, although necessary for multicultural understanding, would not facilitate this statistical analysis. By classifying students into these limited categories, the researchers began to examine how ethnic background impacts the tutoring process; the need for this kind of research has been noted by Maxwell (1991).

Instrument

The survey that was made available electronically to all students taking classes in the General College mathematics program contained questions regarding students' socioeconomic status (SES) as well as questions regarding their perceptions of the mathematics program and the Math Center. This survey has been conducted during the last three weeks of the fall term since 1999. However, demographic questions were added only in 2003 and expanded to include new SES factors—including items such as parental income and ethnic identification—in 2004.

The survey used a Likert-type scale with space available for students to add additional comments. The SES factors included in this survey were: a) gender, b) ethnic identification, c) parental income, d) highest level of parents' education, and e) home environment (urban, rural, suburban, and non-metro city). All of these SES factors were used as independent, attribute variables to parse students' responses.

Students were asked to respond to a variety of statements regarding the Math Center. These statements asked students how often they worked in the Math Center, if the tutors showed respect and concern for them as a student, how often they used the computers, if they felt more confident after using the Math Center, if they worked alone or in groups, if they felt distracted in the Math Center, and if the Math Center encouraged them to explore mathematics and to be independent.

Analysis

The research team analyzed the responses regarding students' interaction with the Math Center on the 2004 questionnaire using SPSS. Because the data had a limited range of responses (only four or five discrete choices), nonparametric data analysis was used. Pearson's chi-square (χ^2) tests were used to identify statistically significant differences between attribute variables and students' responses. Only those questions that were statistically significant, equal to or greater than .05 level of confidence, were reported. In addition to looking for differences between students' use and perception of the Math Center and SES factors, they looked for possible differences between course grades and students' use and perception of the Math Center.

Results

Researchers first looked for a difference in students' responses regarding their use and perception of the Math Center by attribute variables. While gender, ethnic identification, highest level of parents' education, and type of home environment were all analyzed for statistically significant differences, only the ethnic identification attribute yielded statistically significant differences in students' use or perception of the Math Center. They found that there were additional statistical differences in students' responses to the use of the Math Center and an increased feeling of confidence after using the Math Center by fall semester course grades.

Ethnic Identification

How often, if at all, students worked in the Math Center varied by ethnic identification χ^2 (9, n = 298) = 26.685, p = .002. The percent of European American students that did not use the lab was greater than all other groups, and the percent of Asian/ Asian American and African/African American students who used the lab 2 or more hours a week was greater than European American students.

Table 1
Crosstab Percent Counts for Weekly Usage of Math Center by Ethnic Identification

On Average, I Worked in the Math Center (hours per week)					
	n	Never	0-1 Hours	2-3 Hours	4 or More Hours
Asian/ Asian American	59	49%	17%	24%	10%
African/African American	55	42%	22%	25%	11%
European American	143	71%	17%	7%	5%
Other	41	46%	17%	27%	10%

Course Grade
How often, if at all, students worked in the Math Center varied by students' fall course grades χ^2 (12, N = 313) = 32.726, p = .001. A larger percent of students earning an A or A- in their mathematics course never used the Math Center. Whether or not students felt more confident after using the Math Center also varied by students' fall course grades χ^2 (12, n = 184) = 24.273, p = .019. The percentage of students who gained confidence (some or very much) as a result of working in the Math Center and earning a B (63%) or C (78%) in their mathematics course was higher than both A students (54%) and students who scored below a C- average (50% and 53%) in their mathematics course. The greatest percentage of students who reported no gains in confidence as a result of working in the Math Center were students who earned an A or a D+/Incomplete in their mathematics course.

Table 2
Crosstab Percent Counts for Statistically Significant Questions by Fall 2004 Mathematics Course Grades

Fall 2004 Mathematics Grade	On Average, I Worked in the Math Center (hours per week)				
	n	Never	0-1 Hours	2-3 Hours	4 or More Hours
D to F	32	44%	25%	22%	9%

D+ or I	3	67%	33%	0%	0%
C- to C+	67	48%	25%	19%	7%
B- to B+	98	51%	14%	29%	6%
A- to A	113	72%	14%	4%	9%

As a Result of Working in the Math Center, I Feel More Confident in Math

	n	Very Much	Some	A Little	Not at All
D to F	21	10%	43%	24%	24%
D+ or I	2	0%	50%	0%	50%
C- to C+	42	33%	45%	10%	12%
B- to B+	57	21%	42%	14%	23%
A- to A+	62	27%	27%	3%	42%

Ethnic Identification and Grades

A statistical analysis of significant differences among the groups was not performed relating weekly hours of usage of the Math Center, grades, and ethnic identification. However, percentages of usage were calculated to look at grades by both ethnic identification and weekly usage of the Math Center. The only self-identified ethnic group to show higher percentages of passing grades by increased usage of the Math Center was African/African American students. The African/African American students who used the Math Center for fewer than 4 hours per week had a 26% to 30% failure rate in their mathematics course compared to those who used the Math Center 4 or more hours per week having only a 17% failure rate. The failure rate for European American students increased as the usage increased. European American students who used the Math Center for 4 or more hours had a higher failure rate than those who never used the Math Center (14% vs. 2%, respectively).

Discussion

Ethnic Identification

While a variety of SES factors were considered in this study, the use of and perception of the Math Center significantly varied only by ethnic identification. African / African American, Asian / Asian American, and those students identified in the "Other" category—which includes Latino, Mixed-Race/Ethnicity, Native American, and other students—used the Math Center more hours per week than their European American counterparts. In fact, the only group to have a higher than expected count for the category of never using the Math Center were those students identifying themselves as European Americans. Two-thirds of all students who used the Math Center for 4 or more hours per week earned a C- or higher grade in the course.

Because tutoring has been shown to improve not only course grades but also retention (MacDonald, 1993), it is especially encouraging that the Math Center is reaching students that have been traditionally underrepresented in the science and mathematics careers for which developmental mathematics courses often serve as gatekeepers (Stage, 1995). This study cannot conclude that using the tutoring services of the Math Center has had a positive effect on these underrepresented students' grades. However, the effectiveness of a multicultural tutoring model in reaching underrepresented students and encouraging their mathematics achievement is certainly an area for further investigation.

Course Grades

The data from this survey indicated that use of the Math Center did result in increased confidence in mathematics ability for students who received B's and C's in their fall semester math courses; the greatest percentage of gain in confidence was among students receiving C's. The one group of students who had the highest percentage of *not* gaining more confidence in math after using the Math Center were those students who received A's during the fall semester. One reason that those students who received A's could have seen no improvement in their confidence is that they may have gone into the semester with already high confidence

Goolsby, Dwinell, Higbee, and Bretscher (1988/1994) found that confidence in one's ability to learn mathematics was the only affective variable found to predict performance in a developmental mathematics program. The pertinent question for this study was not if you felt confident in mathematics but have you gained confidence as a result of working in the Math Center. Researchers only concluded that students who earned a B or C level grade in their mathematics course and used

the Math Center did gain confidence. A number of other studies have reiterated the importance of confidence in one's ability to do mathematics on mathematics achievement tests (Gourgey, 1992). It is encouraging that use of the Math Center by students receiving B's and C's increased their feeling of confidence in their mathematical abilities.

Ethnic Identification and Grades

The data show that a larger percent (84%) of African/African American students who use the Math Center for 4 or more hours per week passed their mathematics courses. For Asian/Asian American and the "Other" racial/ethnic category, use of the Math Center for over 2 hours per week increased student' success-rates in their mathematics courses. Only European Americans showed a significantly higher success-rate than other student groups when never using the Math Center. Students who earned A's in their mathematics courses were significantly less likely to have used the Math Center than those receiving other grades. However, for African/African American students, failure in a mathematics course was reduced from 30% to 16.7% when using the Math Center for 4 or more hours per week.

Implications

Research regarding the effectiveness of learning centers as sites of developmental education is increasingly important as more developmental education programming is shifted out of the traditional classroom. One area of future research that is begged by this study is the need to move beyond self-reported data with regard to the impact of learning centers and other models of program delivery on student achievement and retention. On the other end of the research spectrum, there is also a need to gather qualitative data regarding students' experiences with innovative tutoring models such as the multicultural approach taken by the General College Math Center.

The data from this survey are an example of the interesting and sometimes surprising information that can be uncovered through program research. The ongoing nature of this research will allow for longitudinal analysis of the changing demographics of the Math Center and how shifts in services and programming affect different students.

This study also highlights the importance for learning center professionals and policy makers of gathering data from a broad range of students in order to effectively understand how services are used and perceived by their students. It is clear that more research needs to be done to focus our attention on the nature of the experience of all students in learning centers. In doing so, we will improve our understanding of

the students who use learning center services and improve our ability to provide these crucial support services to those students who most need them.

References

Academic Resource Center. (2003). *Annual report, 2002-2003: Promoting academic success in writing, computer skills, and math.* Minneapolis, MN: Author. Retrieved August 18, 2005, from *http://www.gen.umn.edu/resources/arc/images/annual_report_2003.pdf*

Boylan, H. R. (1997). The case for program research in developmental education. *The Learning Assistance Review, 2*(2), 20-34.

Caboni, T. C., & Adisu, M. (2004). *A Nation at Risk* after 20 years: Continuing implications for higher education. *Peabody Journal of Education, 79*(1), 164-176.

Duranczyk, I. M., & Opitz, D. L. (2005). Reaching for the standards, embracing diversity: Students' perceptions of the mathematics program. In J. L. Higbee, D. B. Lundell, & D. R. Arendale (Eds.), *The General College vision: Integrating intellectual growth, multicultural perspectives and student development* (pp. 479-517). Minneapolis: University of Minnesota.

General College Math Center. (2003). *Math undergraduate teaching assistant handbook.* Retrieved August 18, 2005, from *http://www.gen.umn.edu/resources/arc/math/staff.htm.*

Gibbs, L. L. (1994). Analysis of developmental mathematics programs in Texas which are successful with Black and Hispanic students. *Dissertation Abstracts International, 55*(06), 1457A. (UMI No. 9428521)

Goolsby, C. B., Dwinell, P. L., Higbee, J. L., & Bretscher, A. S. (1994). Factors affecting mathematics achievement in high risk college students. In M. Maxwell (Ed.), *From access to success: What works best in college learning assistance* (pp. 253-259). Clearwater, FL: H & H. (Reprinted from *Research & Teaching in Developmental Education, 4*(2), 18-27, 1988)

Gourgey, A. F. (1992). Tutoring developmental mathematics: Overcoming anxiety and fostering independent learning. *Journal of Developmental Education*, *15*(3), 10-14.

MacDonald, R. B. (1993). Group tutoring techniques: From research to practice. *Journal of Developmental Education, 17*(2), 12-14, 16, 18.

Maxwell, M. (1991). The effects of expectations, sex, and ethnicity on peer tutoring. *Journal of Developmental Education, 15*(1), 14-16, 18.

Maxwell, M. (1994). *When tutor meets student*. Ann Arbor: University of Michigan.

Maxwell, M. (1997). *Improving student learning skills* (Rev. ed.).Clearwater, FL: H&H.

Miksch, K. L., Bruch, P. L., Higbee, J. L., Jehangir, R. R., & Lundell, D. B. (2003). The centrality of multiculturalism in developmental education. In J. L. Higbee, D. B. Lundell, & I. M. Duranczyk (Eds.), *Multiculturalism in developmental education* (pp. 5-13). Minneapolis: University of Minnesota, General College, Center for Research on Developmental Education and Urban Literacy.

Opitz, D. L. (2003, September). Multicultural math tutoring? The role of training. Paper presented at the Minnesota Association of Developmental Educators conference, Grand Rapids. Retrieved August 18, 2005, from *http://www.gen.umn.edu/resources/arc/images/MNADE_2003.ppt#1*

Opitz, D. L., & Hartley, D. A. (2005). Collaborative learning beyond the classroom: The Academic Resource Center. In J. L. Higbee, D. B. Lundell, & D. R. Arendale (Eds.), *The General College vision: Integrating intellectual growth, multicultural perspectives and student development* (pp. 395-413). Minneapolis: University of Minnesota.

Perin, D. (2004). Remediation beyond developmental education: The use of learning assistance centers to increase academic preparedness in community colleges. *Community College Journal of Research & Practice, 28*(7), 559-582.

Stage, F. K. (1995). The college classroom: Gender and perceptions of the environment. *Research & Teaching in Developmental Education, 11*, 97-104.

Starks, G. (1989). Retention and developmental education: What the research has to say. *Research & Teaching in Developmental Education, 6*(1), 21-32.

Trammell, J. (2005). Learning about the learning center: Program evaluation for learning assistance programs. *The Learning Assistance Review, 10*(2), 31-40.

Irene M. Duranczyk *is an associate professor of developmental mathematics at the University of Minnesota in Minneapolis, where she regularly teaches beginning and intermediate algebra and serves as a co-editor of the annual monographs of the Center for Research on Developmental Education and Urban Literacy (CRDEUL). She is co-editor of the* The Learning Assistance Review. *Her research interests include qualitative and quantitative evaluations of developmental mathematics programs and assessing the effectiveness of sociocultural learning theory within the developmental mathematics classroom. Previously (1992-2002) she was the program administrator of developmental mathematics in the department of Mathematics at Eastern Michigan University. Correspondence concerning this article should be addressed to 128 Pleasant Street SE, Minneapolis, MN 55455, 612-626-4421. Email:*duran026@umn.edu. ***Emily Goff*** *is the coordinator of the PASS IT project, a grant-funded initiative to disseminate information and materials regarding UID in higher education. Emily has over 10 years of experience working in K-16 educational settings. She has taught English as a Second Language (ESL), Portuguese, and basic reading in elementary schools, community colleges, research universities, and in adult basic education programs in the United States and Brazil. She has served as a member of the editorial team for peer-reviewed journals, monographs, as well as various books and proceedings. She is currently completing her PhD in Education with a focus on adult literacy.* ***Donald L. Opitz*** *is teaching specialist in mathematics and coordinator of the Math Center at the University of Minnesota, General College. His research interests include issues in science and mathematics pedagogy and topics in the history of science and mathematics.*