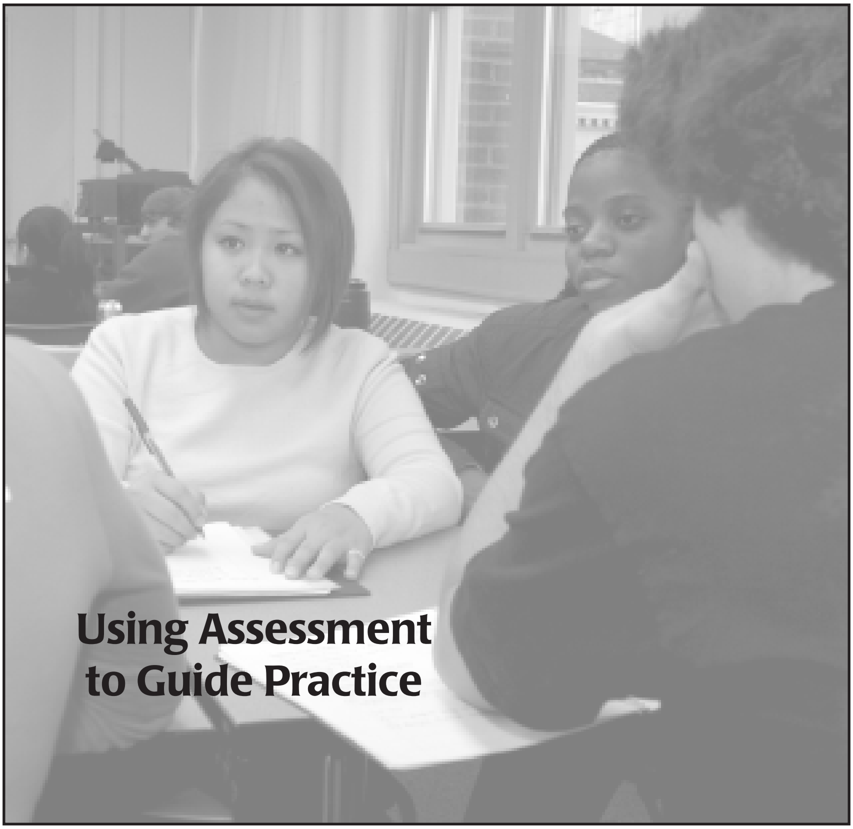

Using Assessment to Guide Practice

Using Assessment to Guide Practice

Introduction

Direct assessment of General College students and course outcomes themselves are other major strengths of faculty and staff in GC. Irene Duranczyk and Don Opitz, who convey the results of an assessment of students' perceptions of the math courses, present an example of an intensive research study done with GC math students. This assessment project examines a range of factors, such as students' socioeconomic status and parents' levels of educational attainment, as it relates to student performance and perspectives.

Student perceptions of GC are also primary to ongoing assessments in the college. Mark Bellcourt, Ian Haberman, Joshua Schmitt, Jeanne Higbee, and Emily Goff offer a chapter that features student voices on the subject of GC and its impact on their learning experience at the University of Minnesota. It is important to include student voices in the evaluation process of curricula, teaching, and theoretical perspectives in higher education.

Randy Moore addresses similar issues in a contemporary context in his chapter on accurate predictors of success for GC students. He asserts that factors related to motivation, like class attendance, are more closely related to achievement than standard measures of aptitude.

CHAPTER 23

Reaching for the Standards, Embracing Diversity: Students' Perceptions of the Mathematics Program

Irene M. Duranczyk and Donald L. Opitz

ABSTRACT

Standards issued by the American Mathematical Association for Two-Year Colleges (AMATYC) for mathematics curricula preceding calculus guide General College's efforts to improve the academic achievement and retention of students who are underrepresented in science, technology, engineering, and mathematics (STEM) careers. Assessment of students' curricular experiences is critical in judging the effectiveness of our mathematics program in meeting AMATYC standards, embracing student diversity, and enabling STEM careers. We present the rationale, design, and results of a survey of students' perceptions of our mathematics program and conclude with a discussion of this survey as an instrument for strategic planning and curriculum development.

The American education system in mathematics and science is differentially effective for students depending on their social class, race, ethnicity, language background, gender, and other demographic characteristics (Mullis et al., 1994; National Council of Teachers of Mathematics [NCTM], 2000; Oaks, 1990; Reese, Jerry, & Ballator, 1997; Secada, 1992; U.S. Department of Education, 1998). Exacerbating the gap in students' success rates, certain groups of students, particularly female students, students who live in poverty, and non-Asian students, are more likely than others to believe that they cannot succeed in mathematics because they do not possess innate mathematical skills (Oaks; Secada; Singham, 1998). Researchers have shown that affective factors, like students' self-perceptions, significantly influence mathematics learning (McLeod, 1993; U.S. Department of Education). The authors of the Third International Mathematics and Science Study (TIMSS) observed, "There was a clear positive association between self-concept and mathematics achievement within every country and within every benchmarking jurisdiction" (Mullis et al., p.129).

General College (GC) provides access to the University of Minnesota's academic programs for students from the broadest range of backgrounds; it is a point of entry for many students marginalized within our differentially effective academic system. Many GC students who take our developmental mathematics courses arrive with the same "fear of math" common to students who had negative experiences in their previous mathematics courses, whether owing to poor teaching or lack of self-confidence (Maxwell, 1997). Among cohorts entering GC between 1999 and 2001, those students who stated an interest in the physical, biological, or computer sciences upon entering were also those students showing the lowest retention rates when compared to other fields of interest (Wambach, Mayer, Hatfield, & Franko, 2003). Further research is needed to understand fully the factors involved in the attrition of GC students pursuing science, technology, engineering, and mathematics (STEM) careers, but the trends are consistent with what is known about the attrition of "at risk" students in the STEM pipeline: among all other factors, students are most often changing career plans to minimize the impact of mathematics in their lives (National Research Council, 1996).

The National Council of Teachers of Mathematics (NCTM) published standards for elementary through secondary (K-12) mathematics education in 1989 that most states adopted between 1992 and 1996 (NCTM, 1991). To recommend guidelines beyond K-12, the American Mathematical Association for Two Year Colleges (AMATYC) published standards in 1995 "intended to revitalize the mathematics curriculum preceding calculus and to stimulate changes in instructional methods so that students will be engaged as active learners in worthwhile mathematical tasks" (Cohen, 1995, p. xii). These efforts were intended to reduce the mathematics achievement gap between students based on their socioeconomic status. However, about 38% of all students enrolled at 2- and 4-year institutions of higher education in the U.S. are still testing into developmental mathematics courses (Reese, Miller, Mazzeo, & Dossey, 1997), and the gap based on socioeconomic status has not diminished (Mullis et al., 1994). There is still a wide gap between the retention of traditional and underrepresented students pursuing STEM fields. General College is committed to incorporating the AMATYC standards for precalculus mathematics education and creating opportunities for underrepresented students to prepare for STEM careers. We propose to take a closer look at how our mathematics program can be more empowering for our socioeconomically diverse college population by exploring if individual demographic groups within our student population perceive our mathematics curriculum differently.

Over the past 8 years, an increasing number of students attending General College enrolled in a reform mathematics sequence in middle school and high school. We observe many students blaming their placement into developmental mathematics courses on the failure of the K-12 reform curriculum. Studies, however, indicate the enhancing effects of elementary, middle, and high school level reform mathematics programs on (a) mathematical achievement on standardized tests, college placement tests, subsequent course grades, and college-level courses; (b) students' attitudes toward mathematics; and (c) access and equity across economic, racial, cultural, gender, and social groups (Coxford & Hirsch, 1996; Hirsch & Coxford, 1997; Huntley, Rasmussen, Villarubi, Sangtong, & Fey, 2000; Schoen & Hirsch, 2003). As we continue to incorporate reform standards into our curriculum, will we meet new areas of resistance? We know that 75% of these same students—those whom GC retains—will succeed in developmental mathematics (Hatfield, 2004). But given the attrition in the STEM pipeline, we need to assess whether student activities in problem solving, modelling, mathematical reasoning, communicating mathematical ideas, connecting mathematics to other disciplines, using technology, and developing mathematical power, are engaging and of sufficient regularity to empower students' progress toward their career objectives, particularly in STEM fields. Do students' perceptions match AMATYC guidelines? Do students feel more competent in their skill development? Do students see the connections between the multiple ways in which mathematical concepts are represented? Do the pedagogical approaches we use meet students' preferences and learning styles and encourage them to think independently and explore mathematics?

In fall 2003 the mathematics teaching faculty designed and administered a new student survey in GC developmental mathematics courses. Through the survey we (a) gathered information on students' perceptions of our developmental mathematics program in relationship with the AMATYC standards for intellectual development, content, and pedagogy; and (b) analyzed whether there were significant relationships between students' perceptions and demographics like age, gender, income, environment, or parents' educational background. This chapter will describe and report on our research and how this model can be used for programmatic review by other institutions.

The Importance of Assessment

Developmental educators are encouraged to assess developmental education programs for tracking student progress, building programs, and justifying developmental education work (Boylan, 1997a, 1997b). Many studies have demonstrated the effectiveness of developmental education through quantitative research methods (Roueche & Roueche, 1993), especially in retaining students (Durant, 1992; England, 1993; Feingold, 1994; Hamilton, 1993; Lyons, 1994; Mireles; Simmons, 1994; Umoh, Eddy, & Spaulding, 1994). Some studies investigated students' attitudes and other success factors within developmental education programs (Berenson, Carter & Norwood, 1992; Duranczyk, 2004; Elliot, 1990; Jones, 1994; Mireles; Stage & Kloosterman, 1995; Wachtel, 1994). Other studies have sought to identify the elements of a successful developmental education program (Bonnett & Newsom, 1995; Durant; Ironsmith, Marva, Harju, & Eppler, 2003). Although only 14% of 2-year colleges and 25% of 4-year institutions engage in ongoing, systematic evaluation, their reports demonstrate a positive correlation between program evaluation and successful outcomes including student retention and academic achievement (Boylan, Bliss, & Bonham, 1997; Casazza & Silverman, 1996; Congos & Schoeps, 1997; Maxwell, 1997). A call for assessment is also embedded in the AMATYC standards (Cohen, 1995), which include principles for assessing mathematics programs. But program assessment is closely wedded to student assessment within the classroom. A premise of our research is that we must consider students' perceptions when evaluating the effectiveness of our programs. By charting how our students are responding to our teaching methods and the levels of confidence they feel after completing our courses, we obtain important sources of information on how well we are meeting our programs' objectives, college mission, and AMATYC standards. This information complements grades and STEM retention data.

We are also acutely aware that students' perceptions of classroom activities and pedagogy may differ from the perceptions of faculty members. This study provides us with the feedback necessary to reflect on our achievements in implementing the standards and highlights areas for improvement. How effectively are we integrating the AMATYC standards for intellectual development, course content, and teaching pedagogy? How effectively are we promoting access across socioeconomic groups?

Background to GC Mathematics Program Assessment

Since 1999, students taking GC mathematics courses have been asked to complete mathematics program questionnaires during the last 3 weeks of the fall term. These questionnaires collected information on student satisfaction and perceptions of the GC mathematics program in the areas of homework, examinations, texts, support materials, and academic resources like mathematics tutoring. Mathematics faculty discussed the survey results each spring and planned curricular changes for implementation in the following academic year. Until now, the survey administrators made no systematic analysis of trends across years, nor have they studied potential demographic differences in responses. A study by Kinney (2001) compared student achievement between classes using computerized instruction (Academic Systems Corporation's Interactive Mathematics®, 1999a, 1999b) and traditional lecture instruction, with an eye toward using technology as a means for implementing AMATYC standards. The results of Kinney's study confirmed the benefits of having alternative classroom formats appealing to students' different learning styles.

Beginning in fall 2003 additional approaches for developmental mathematics education were implemented. In addition to the computer-assisted and lecture-based mathematics courses, project-based and inquiry-based courses were also taught at GC. Faculty chose to use a variety of beginning and intermediate algebra texts to complement their diverse delivery styles (see Chapter 14).

Research Design

Previously the survey queried students' opinions of the quality of the mathematics program and their usage of the program resources, delimited in the previous section, to meet educational goals. Because we wanted to learn if we are differentially effective with our diverse student population, in fall 2003 we modified the questionnaire to collect the following new information: (a) students' self-reported socioeconomic status (SES), defined by demographics that include age, gender, parental income, college-generation status, neighborhood of upbringing; (b) students' perceptions of how effectively the mathematics program addresses GC's mission; and (c) students' perceptions of how effectively the GC mathematics program met AMATYC's major recommendations for introductory college mathematics before calculus. Twelve questions of the 2003 survey remained consistent with surveys given in 2001 and 2002. Six of these questions addressed the effectiveness of the Math Center, which provides drop-in tutoring, and six addressed pedagogical aspects of the GC mathematics courses.

Every year students participated on a voluntary and anonymous basis. Some instructors offered students extra credit as an incentive to participate. All submitted student questionnaires are analyzed in this chapter. We made case-by-case exclusions for missing data, so even though we had 178 completed surveys in 2003, most items have a sample size (n) of less than 178. Similarly, 2001 and 2002 data also have varying sample sizes.

In 2001 and 2002 students completed a paper, bubble-sheet version of the survey, and results were summarized using Microsoft Excel. In 2003 we invited students by announcements made in classes and by e-mail to complete online questionnaires accessible via a URL link. Data from 2003 questionnaires were analyzed using the *Statistical Package for the Social Sciences* (SPSS©) for Windows (Version 11.5.0).

We analyzed all of the sections and questions of the 2003 questionnaire first by noting frequencies of responses. We did not assume a normal distribution and we had categorical data, so we used nonparametric tests for the data analysis. First, we performed Pearson's chi-square (χ^2) tests to check for correlations between mathematics courses taken and SES demographic categories. Then we performed Pearson's χ^2 tests to determine whether significant differences existed among the responses categorized by course number or SES demographic groups. We used Cramér's phi $(\Phi)_c$ to quantify strengths of association. We analyzed the frequencies of student responses to the 12 common questions from 2001 through 2003 using Pearson's χ^2 tests to see if there were statistically significant dependencies between the responses and the year of the survey.

Results

The findings are organized into the six sub-sections following the organization of the student survey: population SES demographics, GC mission, intellectual development, content, pedagogy, and the Math Center. This chapter focuses on questions in the survey that support the GC mission and our multicultural efforts. In each of these sub-sections, we report (a) summary frequency data; (b) Pearson's χ^2 tests, with Cramér's phi $(\Phi)_c$ tests for strengths of association when there are significant differences among the groups based on population demographics or SES; and (c) Pearson's χ^2 tests when there are significant differences in students' responses between the years 2001 and 2003 on the 13 common questions asked in the survey.

Population Demographics

Our 2001, 2002, and 2003 populations consisted of all students registered for courses in introductory or intermediate algebra. The courses included GC712, the first of a two-semester sequence in introductory algebra; GC721, a one-semester, introductory algebra course; GC722, a one-semester, computer-mediated introductory algebra course; GC731, a one-semester, intermediate algebra course; and GC732, a one-semester, computer-mediated intermediate algebra course. In 2001, 492 out of 807 students (61%) participated in the survey; in 2002, 331 out of 520 students (64%) participated; and in 2003, 178 out of 490 students (36%) participated. Populations in GC721 and GC731—the lecture courses—had the lowest response rates (18% and 31% respectively). GC712, GC722, and GC732—classes held in computer classrooms—had the largest response rates (64%, 68%, and 54% respectively).

The 2003 survey was the only survey that collected background data beyond students' primary college of enrollment, so it is the only year for which we can describe and analyze the data based on SES demographics. Because 94% of the students reported GC as their college of enrollment, and 96% reported ages between 18 and 23 years old, we did not analyze responses by these two characteristics. By gender, the respondents were 57% female. This is higher than the general population of GC, which in 2003 was only 50% female. We used three categories to identify family income: (a) below $35,000 (poverty limit in Minnesota), (b) between $35,000 and $45,000 (average range of family income in Minnesota), and (c) above $45,000 (above average range of family income in Minnesota). Thirty-seven percent of the students did not answer this question, and 21% of the students indicated a family income below $35,000. Of the respondents, 35% identified that they were first-generation college students, while 43% indicated that at least one of their parents had a college degree. Of the responding students, 45% lived primarily in urban neighborhoods during their upbringing. Table 1 contains all the demographic counts and percentages.

We tested for possible dependencies between course numbers and SES data. This revealed a dependency between course number and (a) first-generation college students, $\chi^2(\mathrm{df} = 4, n=159) = 15.288, p = .004$, and (b) students' neighborhoods of upbringing, $\chi^2(\mathrm{df} = 8, n = 167) = 23.329, p = .003$. There were greater percentages of students from urban neighborhoods (75%) and of first-generation college students (59.5%) in GC712 than in other courses. Both intermediate algebra courses (GC731 and GC732) had lower percentages of first-generation college students.

GC Mission

To carry out GC's mission statement, the college strives to offer class sizes that are conducive to personalized attention. Of the responding students, 83% believed that GC accomplished this goal, perhaps unsurprising as far as mathematics courses are concerned. GC's developmental mathematics courses have maximum enrollments of 40 students as opposed to the University of Minnesota's credit-bearing survey courses in mathematics (e.g., precalculus and calculus) conducted in large lecture halls supporting more than double this number. Our survey measured three other areas guided by GC's mission: (a) courses teach strategies and study skills in addition to mathematics content (70% agreed); (b) courses enable students to learn more about how to succeed in a university setting (55% agreed); and (c) courses enabled students to reflect on their learning interests, skills, and weaknesses and set attainable academic and career goals (61% agreed; see Figure 1).

Two questions regarding the GC mission showed statistically significant differences in responses, one by parents' level of education and one by parents' income. When answering the question, "Class size at GC is conducive for

TABLE 1

Frequency and Percent Response for Population Demographics, Fall 2003

Category	Possible responses	*n*	Percent
Course number	GC712	39	22
	GC721	27	15
	GC722	25	14
	GC731	69	40
	GC732	14	8
	Missing	4	2
Gender	Female	101	57
	Male	74	42
	Missing	3	2
Parent's income	Below $35,000	37	21
	$35,000–45,000	23	13
	Above $45,000	53	30
	Missing	65	37
First-generation college student	Yes	62	35
	No	99	56
	Missing	17	10
Highest level of education either parent reached	College degree	77	43
	Voc/tech coursework	33	19
	High school diploma	36	20
	Less than high school diploma	30	17
	Missing	2	1
Neighborhood of upbringing	Urban	80	45
	Rural	25	14
	Suburban	65	37
	Missing	8	5

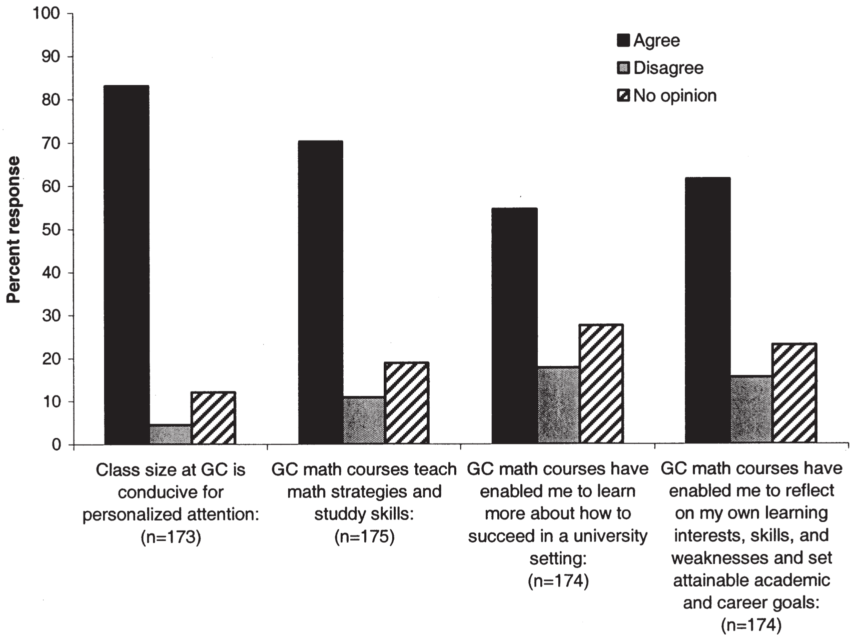

Figure 1. Student responses (N=178) to questions related to the GC mission.

personalized attention," $\chi^2(\text{df} = 8, n = 173) = 25.930, p = .001$, 9% of the participants whose parents have college degrees disagreed with the statement compared to 0% in each of the other categories of students. One-hundred percent of the students whose parents had a vocational or technical degree agreed that the class size was conducive for personalized attention. For the question, "GC math courses have enabled me to reflect on my own learning interests, skills, and weaknesses and set attainable academic and career goals," $\chi^2(\text{df} = 4, n = 174) = 13.429, p = .009$, more students than expected (a) had "no opinion" if their parents earned below $35,000 annually (33%), (b) "disagreed" if their parents earned between $35,000 and $45,000 (39%), and (c) "agreed" if their parents earned above $45,000 (71%).

Intellectual Development

We asked eight questions relating to the seven areas of intellectual development recommended by AMATYC standards: (a) mathematical problem solving; (b) modelling real-world situations; (c) developing mathematical arguments; (d) appreciating mathematics as a growing discipline, interrelated with other facets of human culture and other disciplines; (e) communicating with mathematics; (f) using appropriate technology as a means for enhancing mathematical understanding and problem solving abilities; and (g) enriching experiences that encourage independent exploration of the power of mathematics. We posed each question in three ways. First, we asked students how often their classes involved activities encouraging their development of a particular skill identified by AMATYC (for example, mathematical problem solving): every class, weekly, occasionally, or never; students could also indicate that they did not understand the question. Next, we asked students to which degree they were engaged in those activities: highly engaged, moderately engaged, somewhat engaged, or not engaged at all; students could also indicate that the questions did not apply. Lastly, we asked students how often they would have preferred performing the activities: every class, weekly, occasionally, or never. Summaries of the eight questions and the frequency of responses provided in the following pages. We will report on the results for (a) modelling real-world situations; (b) appreciating mathematics as a growing discipline, interrelated with other facets of human culture and other disciplines; (c) communicating with mathematics; (d) using appropriate technology as a means for enhancing mathematical understanding and problem solving abilities; and (e) enriching experiences that encourage independent exploration of the power of mathematics.

Modelling real-world situations. Of the respondents, 48% reported at least weekly activities applying mathematics to real-world situations, 60% of the respondents were moderately or highly engaged in the activity, and 69% of them preferred activities that applied mathematics to real-world situations at least weekly. There were no statistically significant differences among the SES groupings or demographics for real-world activities.

Appreciating mathematics as a growing discipline. Thirty-seven percent of the students observed class activities connecting mathematics, culture, and other disciplines occurring at least weekly, 50% found these activities moderately or highly engaging, and 50% would prefer activities encouraging the use of class activities connecting mathematics, culture, and other disciplines at least weekly. There were statistically significant differences among students based on the course of enrollment, $\chi^2(\mathrm{df} = 12, n = 164) = 28.394, p = .005$. The computer-mediated courses had more than 80% of their students reporting that activities connecting math, culture, and other disciplines occurred only occasionally or never. Students in GC721 reported the largest occurrence of activities interrelating mathematics with human culture and other disciplines.

Communicating with mathematics. Thirty-five percent of the students observed class activities encouraging them to read and write about mathematics at least weekly, 36% found these activities moderately or highly engaging, and only 35% would prefer activities encouraging reading and writing about mathematics. Class activities encouraging students to discuss mathematics were observed as occurring at least weekly by 35% of the students, 38% of the students found these activities moderately or highly engaging, and 42% of the students would prefer activities encouraging the discussion of mathematics. There were significant differences among the groups in response to this question.

The χ^2 analysis of student responses and course enrollment showed a dependency among courses and (a) level of engagement when activities encouraged students to read and write about mathematics, $\chi^2(\text{df} = 16, n = 173) = 31.936, p = .010$; (b) frequency of activities encouraging students to discuss math, $\chi^2(\text{df} = 12, n = 169) = 22.861, p = .029$; and (c) level of engagement when activities encouraged students to discuss mathematics, $\chi^2(\text{df} = 16, n = 172) = 30.767, p = .014$. The percentage of students in GC712 stating that activities encouraged them to discuss mathematics in every class was at least twice the percentage in each of the other courses. Only 8% of students in GC732 stated that activities encouraging them to discuss mathematics occurred in every class or weekly (see Table 2). Students in GC712 reported higher levels of engagement than students participating in any other GC developmental math course in discussing mathematics and higher levels of engagement when activities encouraged them to read and write about mathematics.

More surprising, the χ^2 analyses revealed significant differences in responses among urban, rural, and suburban students when asked about their (a) preference in the occurrence of activities encouraging discussion in mathematics, $\chi^2(\text{df} = 6, n = 165) = 17.470, p = .008$; and (b) level of engagement when activities encouraged mathematics discussions, $\chi^2(\text{df} = 8, n = 168) = 18.495, p = .018$. Of urban students, 21% , contrasted with 5% of suburban students, preferred daily class activities encouraging discussion in mathematics. Of urban students, 25% preferred only occasional mathematics discussions as opposed to 52% of suburban students (see Table 2).

Use of appropriate technology. Forty-five percent of the students reported class activities using technology at least weekly, 46% found these activities moderately or highly engaging, and 55% would prefer at least weekly activities using technology to enhance mathematical learning. The χ^2 analysis showed differences among the groups based on courses enrolled and responses to (a) the frequency of classes using technology to enhance mathematical learning, $\chi^2(\text{df} = 12, n = 171) = 103.976, p = .000$; (b) students' level of engagement in activities using technology, $\chi^2(\text{df} = 16, n = 172) = 49.921, p = .000$; and (c) students' preferences in how often technology use should occur, $\chi^2(\text{df} = 12, n = 171) = 52.073, p = .000$. The percentages of student responses for use of technology in every class were largest in computer-mediated courses (GC722 and GC732). GC712 had the largest percentage for weekly and occasional use of technology in class. Students reported higher levels of

TABLE 2

Percent Response for Questions on Communication of Mathematics by Course or Childhood Environment, Fall 2003 ($N = 178$)

		Level of engagement when activities encouraging reading and writing about mathematics				
Course number	*n*	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
712	39	12.8%	28.2%	28.2%	15.4%	15.4%
721	27	14.8%	18.5%	44.4%	7.4%	14.8%
722	24	12.5%	20.8%	25.0%	0.0%	41.7%
731	69	2.9%	37.7%	23.2%	15.9%	20.3%
732	14	0.0%	14.3%	14.3%	14.3%	57.1%

	Occurrence of activities encouraging students to discuss mathematics				
Course number	*n*	Every class	Weekly	Occasionally	Not at all
712	38	31.6%	18.4%	36.8%	13.2%
721	25	16.0%	16.0%	36.0%	32.0%
722	25	16.0%	8.0%	44.0%	32.0%
731	68	10.3%	27.9%	41.2%	20.6%
732	13	0.0%	7.7%	38.5%	53.8%

		Level of engagement when activities encouraging students to discuss mathematics				
Course number	*n*	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
712	39	12.8%	38.5%	33.3%	7.7%	7.7%
721	25	12.0%	32.0%	12.0%	12.0%	32.0%
722	25	16.0%	8.0%	44.0%	12.0%	24.0%
731	69	8.7%	26.1%	40.0%	7.2%	15.9%
732	14	0.0%	21.4%	42.0%	0.0%	57.1%

		Level of engagement when activities encouraging students to discuss mathematics				
Students' childhood environment	*n*	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
Urban	79	19.0%	22.8%	30.4%	10.1%	17.7%
Rural	25	0.0%	44.0%	44.0%	4.0%	8.0%
Suburban	64	6.3%	25.0%	31.3%	7.8%	29.7%

	Preference for activities encouraging students to discuss mathematics				
Students' childhood environment	*n*	Every class	Weekly	Occasionally	Never
Urban	79	20.3%	34.2%	25.3%	20.3%
Rural	25	12.0%	32.0%	44.0%	12.0%
Suburban	65	4.6%	20.0%	52.3%	23.1%

engagement in technology-based activities in the computer-mediated courses. Students' preferences for the use of technology varied, with computer-mediated courses having higher percentages of students preferring technology in every class (see Table 3).

When looking at students' preferences in the use of technology in class, we found significant differences between first-generation and non-first-generation students, $\chi^2(\mathrm{df} = 3, n = 158) = 103.976, p = .034$. First-generation students had a higher percentage (32.2%) preferring the use of technology in every class.

Enriching experiences. Forty-six percent of the students observed class activities encouraging students to explore mathematics independently occurring at least weekly, 47% found these activities moderately or highly engaging, and 50% would prefer such activities at least weekly. We found significant differences between the groups by course of enrollment, $\chi^2(\mathrm{df} = 16, n = 171) = 27.961, p = .032$, and generation in college, $\chi^2(\mathrm{df} = 4, n = 158) = 10.267, p = .036$, among students' responses to questions on their level of engagement in class activities encouraging independent exploration of mathematics. A larger percentage of students in computer-mediated courses (33.3% and 28.6%) rated themselves highly engaged when class activities encouraged them to independently explore mathematics compared to 7.2% of GC731 students rating themselves highly engaged. While 25% of GC731 students responded that the question did not apply to their course, 3% of students in GC712 stated that this question did not apply to their course. First-generation college students rated themselves above the expected percentages for being highly engaged (18.6%) and moderately engaged (42.4%) in activities encouraging them to independently explore mathematics. Non-first-generation college students rated themselves slightly below the expected percentages in both categories. The reverse relationship existed for somewhat engaged, not engaged at all, and not applicable (see Table 4).

Content

Ten questions queried students' levels of confidence in content areas addressed by the AMATYC standards for mathematics. In only three areas did more than 20% of the students rate their courses as helping very little or not at all in increasing their confidence or competence. The three areas were: (a) translating situations into pictures and using measurement for solving mathematics problems, (b) using statistical and counting skills to solve problems and to make inferences about real-world situations, and (c) using mathematical logic to reason through situations.

When asked about the amount of new material presented in the introductory and intermediate algebra courses, 87% of the respondents said that their

TABLE 3

Percent Response for Questions on Appropriate Use of Technology by Course and SES, Fall 2003 ($N = 178$)

Course number	n	Occurrence of technology used to enhancing mathematical understanding: Every class	Weekly	Occasionally	Not at all	
712	39	12.8%	46.2%	35.9%	15.1%	
721	25	4.0%	16.0%	52.0%	28.0%	
722	25	60.0%	12.0%	24.0%	4.0%	
731	68	0.0%	29.4%	30.9%	39.7%	
732	14	78.6%	7.1%	14.3%	0.0%	
		Level of engagement using technology				
Course number	n	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
712	38	8.4%	28.9%	42.1%	7.9%	2.6%
721	26	11.5%	23.1%	30.8%	7.7%	26.9%
722	25	40.0%	36.0%	20.0%	0.0%	4.0%
731	69	7.2%	26.1%	24.6%	8.7%	33.3%
732	14	57.1%	21.4%	21.4%	0.0%	0.0%
		Preference for using technology				
Course number	n	Every class	Weekly	Occasionally	Never	
712	39	25.6%	35.9%	33.3%	5.1%	
721	26	7.7%	26.9%	12.0%	15.4%	
722	25	48.0%	36.0%	44.0%	0.0%	
731	67	7.5%	32.8%	40.0%	22.4%	
732	14	71.4%	21.4%	42.0%	0.0%	
		Preference for using technology				
First generation college student	n	Every class	Weekly	Occasionally	Never	
Yes	59	25.6%	30.5%	32.2%	5.1%	
No	99	7.7%	33.3%	33.3%	17.2%	
		Level of engagement using technology				
Parents' income	n	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
Below $35,000	36	19.4%	19.4%	47.2%	5.6%	8.3%
$35,000–$45,000	23	17.4%	43.5%	21.7%	4.3%	13.0%
Above $45,000	17.3	17.3%	25.0%	19.2%	7.7%	30.8%

TABLE 4

Percent Response for Questions on Enriching Experiences Encouraging Independent Exploration by Course Number and SES, Fall 2003 (N = 178)

		Occurrence of enriching experiences encouraged independent exploration			
Course number	*n*	Every class	Weekly	Occasionally	Not at all
712	38	21.1%	21.1%	47.4%	10.5%
721	24	20.8%	25.0%	29.2%	25.0%
722	24	54.2%	8.3%	25.0%	12.5%
731	66	15.2%	25.8%	33.3%	25.8%
732	13	38.5%	23.1%	0.0%	38.5%

		Level of engagement when enriching experiences encouraged independent exploration				
Course number	*n*	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
712	38	15.8%	26.3%	44.7%	10.5%	2.6%
721	26	15.8%	26.9%	30.8%	11.5%	15.4%
722	25	33.3%	37.5%	12.5%	8.3%	8.3%
731	69	7.2%	36.2%	24.6%	7.2%	24.6%
732	14	28.6%	14.3%	21.4%	14.3%	21.4%

		Preference for using technology				
First generation college student	*n*	Highly engaged	Moderately engaged	Somewhat engaged	Not at all engaged	NA
Yes	59	18.6%	42.4%	25.4%	3.4%	10.2%
No	99	14.1%	23.2%	32.3%	12.1%	18.2%

		Preference for enriching experiences encouraged independent exploration			
Gender	*n*	Every class	Weekly	Occasionally	Never
Female	98	27.6%	20.4%	33.7%	18.4%
Male	74	13.5%	37.8%	29.7%	18.9%

instructors presented new material at least weekly, while 63% of respondents reported that their instructors presented topics that they had before but did not remember well. Of the responding students, 84% thought that their placement was about right, and 85% believed that they were well prepared for their next mathematics class.

For three of the content questions there were significant differences between the groups by SES data (see Table 5). For the question, "Within the course topics, new material was presented: Every class, weekly, occasionally, not at all," there were statistically significant differences between responses by course number, $\chi^2(\text{df} = 12, n = 172) = 23.880, p = .021$, and parents' income levels, $\chi^2(\text{df} = 4, n = 167) = 10.224, p = .037$. The largest differences among the groups were in the percentages reported for new material being presented in every class or weekly. Of the students in GC721, 73% reported new material in every class while only 15% reported new material weekly. In GC722 only 28% reported new material in every class while 56% reported new material weekly. Looking at the same question by parental income, we found that 33.3% of the students who reported that their parents made less than $35,000 per year indicated that new material was presented in every class, and only 28% indicated occasionally encountering new material in class. Students reporting that their parents make more than $35,000 per year also indicated that new material was presented daily at higher percentages (52% and 54%) and that new material was occasionally presented at lower percentages (9% and 6%) than the students in the below $35,000 income group. All income groups had similar percentages when reporting that new material was presented weekly.

This question was also asked on the 2001 and 2002 surveys (see Table 6). Pearson χ^2 results indicated significant differences over the years, $\chi^2(\text{df} = 12, n = 976) = 160.506, p = .000$. The percentage of students reporting new material being covered in every class and at least weekly has greatly increased over the past 3 years. Likewise, the proportion of students who reported never seeing new material or only occasionally seeing new material has continued to decrease from 66% in 2001 to only 12% in 2003.

Two questions showed significant differences in responses by gender. When reporting on the question "This class helped me feel more competent using functions as an approach to problem solving," $\chi^2(\text{df} = 3, n = 167) = 13.703, p = .003$, women had lower percentages in the response to very much (30%), very little (3.2%), and not at all (5.3%), while men had higher percentages, 36%, 17%, and 8% respectively. Men's responses of "somewhat" (40%) were lower than women's (62%). The other question showing a gender dependency was, "Within the course topics, material that I have seen before but did not remember was presented: Every class, weekly occasionally or never," χ^2 (df = 3, $n = 170) = 10.872, p = .012$. Of the women, 30% reported this

TABLE 5

Percent Response for Questions on Content
by Course Number or SES, Fall 2003 ($N = 178$)

		Within the course topics, new material was presented:			
Course number	*n*	Every class	Weekly	Occasionally	Not at all
712	38	28.9%	55.3%	13.2%	2.6%
721	26	73.1%	15.4%	11.5%	0.0%
722	25	28.0%	56.0%	16.0%	0.0%
731	69	58.0%	30.4%	11.6%	0.0%
732	14	42.9%	50.0%	7.1%	0.0%
		Within the course topics, new material was presented:			
Parents' income	*n*	Every class	Weekly	Occasionally	Not at all
Below $35,000	36	33.3%	38.9%	27.8%	0.0%
$35,000–$45,000	23	52.2%	39.1%	8.7%	0.0%
Above $45,000	52	53.8%	40.4%	5.8%	0.0%
		This class helped me to feel more competent using functions as an approach to problem solving:			
Gender	*n*	Very much	Somewhat	Very little	Not at all
Female	98	29.5%	62.1%	3.2%	5.3%
Male	72	36.1%	38.9%	16.7%	8.3%
		Within course topics, material that I have seen before but did not remember was presented:			
Gender	*n*	Every class	Weekly	Occasionally	Not at all
Female	98	29.6%	30.6%	36.7%	3.1%
Male	72	16.7%	50.0%	25.0%	8.3%

occurred in every class compared to 17% of the men. While 50% of the men reported this occurred weekly only 31% of the women reported this occurrence weekly. This question was also asked on each of the surveys over the past 3 years. Here too, over the 3-year period more students have recognized more material that they have seen before but did not remember. There is a significant difference over the years, $\chi^2(\text{df} = 12, n = 929) = 19.810, p = .000$. From 2001 to 2003 a decreasing proportion of students recognized material in every class that they have seen before but did not remember. Over the years, an increasing percentage of the students have reported recognizing material that they have seen before only occasionally or never.

Each student survey since 2001 asked students to judge the appropriateness of their placement. Here too, Pearson's chi-square tests indicated a significant

TABLE 6

Chi-Square Results and Percent Response to Questions on Texts, Computer Software, and Placement from Fall 2001, Fall 2002, and Fall 2003

Question from survey	Response options	2001 N=492	2002 N=331	2003 N=178	χ^2
The text helped me to learn the content of the course:	Not at all	9.9	7.6	4.6	
	Very little	25.8	21.0	12.6	
	Somewhat	52.1	60.1	49.7	
	Very much	12.2	11.3	33.1	
					60.334
The computer software helps me to learn the content of the course	I did not use	50.4	53.8	39.3	
	Not at all	9.5	12.8	16.2	
	Somewhat	23.4	19.5	26.0	
	Very much	16.7	14.0	18.5	
					14.298
On average, I used computer software	Never	57.7	64.8	41.7	
	0–1 hrs/wk	12.4	8.3	18.3	
	2–3 hrs/wk	14.0	10.4	17.7	
	4–5 hrs/wk	13.0	14.4	15.4	
	6–8 hrs/wk	2.9	2.1	1.7	
	Over 9 hrs/wk	0	0	5.1	
					68.302
Within the course topics, new material was presented:	not at all	19.0	17.3	.6	
	Occasionally	46.9	39.2	11.3	
	Weekly	19.4	25.0	38.7	
	Every class	14.7	18.5	49.4	
					160.506
Within the course topics, material that I have seen before but did not remember was presented:	not at all	4.6	1.8	5.5	
	Occasionally	25.9	28.8	32.1	
	Weekly	28.0	30.2	37.6	
	Every class	41.5	39.3	24.9	
					19.810
My placement in this course was:	Too low	48.7	44.7	14.3	
	About right	46.0	50.3	57.1	
	Too high	.2	.7	2.4	
	Not sure	5.1	4.3	14.3	
					44.494

difference over the years, χ^2(df = 12, n = 948) = 44.494, p = .000. A smaller percentage of students are now reporting that their placements are too low. In 2001, 49% of the students indicated that their placement was too low, and in 2003 only 26% of the students made the same claim. In 2001 and 2002, 46% of the students indicated that their placement was about right, and in 2003 it increased to 57%.

Pedagogy

The survey posed 12 questions about pedagogy: activities promoting (a) collaboration, (b) speaking and presenting, (c) use of multiple approaches to problem solving, (d) independent thinking and exploration, (e) lecture-based teaching, and (f) computer-based teaching. In these areas, we asked students how often they did the particular activities in their class and how often they *preferred* that they *should* be done. In this chapter, we report on (a) collaboration, (b) speaking and presenting, (c) lecture-based teaching, and (d) computer-based teaching. Three additional questions were posed to explore the extent of students' use of computer software, the value of computer software to the course, and the value of the mathematics text (see Table 7). This area of the survey generated the largest number of significant differences between the groups. Only three questions about pedagogy revealed no significant differences between any groups, but there were significant differences between groups defined by course number for six of the questions and by SES data for five of the questions (see Tables 7, 8, and 9). We will now look at each of these areas for general trends, significant differences between the groups, and significant differences that occurred over the 3-year period of data collection.

Collaborative activities (group work). Only 21% of the respondents stated that their classes worked collaboratively in groups on activities at least weekly, whereas 63% said collaborative group activities never occurred. However, 30% stated that they would prefer their classes to work collaboratively in groups at least weekly. An even greater percentage, 35%, stated that they would prefer that collaborative group work never occur.

The response to this question was statistically significant when looking at the course number, χ^2(df = 12, n = 171) = 75.322, p = .0009, and neighborhood of upbringing, χ^2(df = 6, n = 167) = 16.375, p = .012. The area with the strongest measure of association was course number (Cramér's Φ_c = .664). The course that had the greatest percentage of students stating that collaborative group activities occurred in every class was GC712 (18.4%). The other courses had fewer than 6% of the students choosing that response. The course with the lowest percentage of students stating that collaborative group activities never occurred was also GC712, 10.5% compared to over 69% in each of the other courses. Urban students (9.1%) stated that collaborative group activities

TABLE 7

Frequency and Percent Response for Questions on Pedagogy, Fall 2003 ($N = 178$)

Question	Possible responses	Frequency	Percent
This class worked collaboratively in groups on activities	Every class	12	6.9
	Weekly	25	14.4
	Occasionally	25	14.4
	Never	112	64.4
I would prefer that the class work collaboratively in groups:	Every class	21	12.1
	Weekly	31	17.8
	Occasionally	59	33.9
	Never	63	36.2
This class encouraged us to speak/present:	Every class	30	17.3
	Weekly	15	8.7
	Occasionally	49	28.3
	Never	72	42.4
I would prefer that the class encourage us to speak/present:	Every class	21	12.4
	Weekly	24	14.1
	Occasionally	53	31.2
	Never	72	42.4
This class encouraged multiple approaches (numerical, graphical, symbolic,and verbal) to solving problems:	Every class	43	24.9
	Weekly	70	40.5
	Occasionally	48	27.7
	Never	12	6.9
I would prefer that the class use multiple approaches:	Every class	39	22.8
	Weekly	58	33.9
	Occasionally	65	38.0
	Never	9	5.3
This class involved activities that encouraged me to think independently and explore:	Every class	45	25.9
	Weekly	61	35.1
	Occasionally	49	28.2
	Never	19	10.9
I would prefer that the class involve activities that encouraged me to think independently and explore:	Every class	41	23.4
	Weekly	66	37.7
	Occasionally	52	29.7
	Never	16	9.1
The class had lectures:	Every class	83	47.4
	Weekly	26	14.9
	Occasionally	15	8.6
	Never	51	29.1
I would prefer that the class have lectures:	Every class	66	37.7
	Weekly	38	21.7
	Occasionally	31	17.7
	Never	40	22.9
This class used computer-based teaching:	Every class	42	24.1
	Weekly	43	24.7
	Occasionally	20	11.5
	Never	69	39.7
I would prefer that the class have computer-based teaching:	Every class	39	22.7
	Weekly	31	18
	Occasionally	39	22.7
	Never	63	36.6

occurred in every class whereas only 4% of the rural students and 3% of the suburban students chose that response. Of the urban students, 23% stated that collaborative group activities occurred weekly, but 0% of the rural and 11% of the suburban students chose that response.

There was also a significant difference in responses to the question of preference for collaborative group activities by course number, $\chi^2(\text{df} = 12, n = 171) = 30.691, p = .002$. Of GC712 students, 24% preferred collaborative group activities in every class compared to less than 10% of the students in all other courses. Only 7.9% of the GC712 students preferred never having collaborative group activities compared to over 40% of the students in each of the other classes.

Speaking and presenting (by students). When asked whether their classes encouraged student presentations, only 26% of the students stated these occurred. A majority, 55%, stated that they would prefer that presentations never occur. Taking a look at student responses by course number there was a significant difference between classes identifying speaking and presenting as a part of the class, $\chi^2(\text{df} = 12, n = 170) = 66.199, p = .000$, and preferring the activity occur, $\chi^2(\text{df} = 12, n = 167) = 40.662, p = .000$ (see Tables 8 and 9). Students in beginning algebra (GC712 and GC721) had the largest percentages (34% and 23% respectively) in reporting speaking and presenting occurring in every class and the lowest percentages (13% and 35% respectively) in reporting that speaking and presenting never occurred in class. When reporting on preference for speaking and presenting in class, the computer-mediated courses (GC722 and GC732) had less than expected percentages in most categories except for preferring that speaking and presenting never occur in class (72% and 86% respectively). In this category they were over 30% higher than any of the other courses. Students in GC712 had the greatest preference for speaking and presenting in every class (21%). The preference for speaking and presenting was also statistically significant for students by parents' highest level of educational attainment, $\chi^2(\text{df} = 12, n = 159) = 33.338, p = .001$. Here, students with parents having either a vocational or technical degree or a high school diploma as their highest level of education preferred never speaking and presenting in class (15% above the other groups, 49% and 69% respectively) and preferred speaking and presenting in every class below the other groups (by over 40%).

Lecture-based teaching. Sixty-one percent of the students reported that their classes had lectures at least weekly, and the same percentage stated that they preferred that lectures be given at least weekly. However, 47% reported that lectures occurred in every class, and only 38% preferred daily lectures. Only by course number was there a significant difference in students' reporting on lecture-based teaching , $\chi^2(\text{df} = 12, n = 172) = 125.457, p = .000$. As

TABLE 8

Percent Response for Questions on Pedagogies by Course Number, Fall 2003 ($N = 178$)

		Occurrence of collaborative group activities			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	23.7%	35.9%	28.9%	7.9%
721	26	7.7%	11.5%	34.6%	46.2%
722	25	8.3%	4.2%	41.7%	45.8%
731	68	10.1%	13.0%	34.8%	42.0%
732	14	7.1%	21.4%	28.6%	42.9%
		Preference for collaborative group activities			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	34.2%	18.4%	34.2%	13.2%
721	26	23.1%	0.0%	42.3%	34.6%
722	24	0.0%	0.0%	8.0%	92.0%
731	69	16.4%	11.9%	34.3%	37.3%
732	14	0.0%	0.0%	0.0%	100.0%
		Preference for activities encouraging speaking or presenting			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	21.1%	28.9%	31.6%	18.4%
721	26	15.4%	7.7%	50.0%	26.9%
722	25	0.0%	4.0%	24.0%	72.0%
731	67	14.4%	15.6%	29.7%	40.6%
732	14	0.0%	0.0%	14.3%	85.7%
		Activities encouraging multiple approaches to problem solving			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	36.8%	42.1%	13.2%	7.9%
721	26	38.5%	34.6%	26.9%	0.0%
722	25	4.0%	28.0%	56.0%	12.0%
731	68	23.5%	45.6%	25.0%	5.9%
732	13	7.7%	38.5%	38.5%	15.4%
		Occurrence of lecture-based teaching			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	39.5%	39.5%	10.5%	10.5%
721	26	76.9%	3.8%	11.5%	7.7%
722	25	0.0%	0.0%	4.0%	96.0%
731	69	65.2%	14.5%	8.7%	11.6%
732	14	0.0%	0.0%	7.1%	92.9%
		Preference for lecture-based teaching			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	31.6%	34.2%	23.7%	10.5%
721	26	61.5%	11.5%	15.4%	11.5%
722	25	0.0%	8.0%	24.0%	68.0%
731	69	52.2%	27.5%	8.7%	11.6%
732	14	0.0%	0.0%	42.9%	57.1%

TABLE 9

Percent Response for Questions on Pedagogies by Course Number, Fall 2003 ($N = 178$)

SES demographics	Occurrence of collaborative group activities				
Neighborhood of upbringing	*n*	Every class	Weekly	Occasionally	Never
Urban	77	9.1%	23.4%	16.9%	50.6%
Rural	25	4.0%	0.0%	12.0%	84.0%
Suburban	65	3.1%	10.8%	10.8%	75.4%
	Preference for activities encouraging speaking or presenting				
Parents' education level	*n*	Every class	Weekly	Occasionally	Never
College degree	75	13.3%	12.0%	41.3%	33.3%
Voc/tech course work	33	6.1%	9.1%	36.4%	48.5%
High school diploma	32	6.3%	9.4%	15.6%	68.8%
Less than high school diploma	8	50.0%	12.5%	12.5%	25.0%
	Preference for multiple approaches to problem solving				
Parents' education level	*n*	Every class	Weekly	Occasionally	Never
College degree	76	26.3%	22.4%	47.4%	3.9%
Voc/tech course work	33	24.2%	42.4%	24.2%	9.1%
High school diploma	33	9.1%	36.4%	48.5%	6.1%
Less than high school diploma	7	28.6%	71.4%	0.0%	0.0%
	Preference for lecture-based teaching				
Gender	*n*	Every class	Weekly	Occasionally	Never
Female	99	42.4%	25.3%	16.2%	16.2%
Male	74	31.1%	16.2%	20.3%	32.4%
Neighborhood					
Urban	78	30.8%	33.3%	17.9%	17.9%
Rural	25	44.0%	20.0%	4.0%	32.0%
Suburban	65	46.2%	10.8%	18.5%	24.6%
	Text help in learning course content				
First-generation college student	*n*	Every class	Weekly	Occasionally	Never
Yes	60	45%	31.7%	20.0%	3.3%
No	99	27.3%	57.6%	10.1%	5.1%

would be expected, the computer-mediated courses were the only courses having no counts for lecture-based teaching in every class or weekly, though sizeable proportions of students responded that they would prefer lectures occasionally. GC712 had the largest percentage of students preferring lectures weekly as opposed to every class, opposite the trend of responses by students in the other lecture-based courses.

When students reported on their preference for lectures in class, differences were statistically significant by course number, $\chi^2(\text{df} = 12, n = 172) = 79.518, p = .000$, gender, $\chi^2(\text{df} = 3, n = 173) = 8.315, p = .040$, and neighborhood of upbringing, $\chi^2(\text{df} = 6, n = 168) = 14.961, p = .021$. The greatest degree of association was by course number (Cramér's $\Phi_c = .680$). Over 50% of the students in GC721 and GC731 preferred lectures in every class, more than 20% above the other courses. Students' preference for lectures by gender indicated women preferring lectures in every class (42%) and weekly (25%) and men preferring lectures in every class (31%) and weekly (16%). Thirty-two percent of the men preferred never having lectures compared to only 16% of the women. Suburban (46%) and rural (44%) students also preferred lectures in every class, as opposed to urban students (30%). Suburban (25%) and rural (32%) students also chose "never" as their response at a higher rate than urban students (18%).

Computer-based teaching. For computer-based teaching, 49% of the students stated that their classes used this method at least weekly, while only 41% preferred it at least weekly. There were significant differences in responses by course number, $\chi^2(\text{df} = 12, n = 171) = 197.625, p = .000$, and students' neighborhood of upbringing, $\chi^2(\text{df} = 6, n = 167) = 14.470, p = .025$ (see Table 10). As would be expected, the computer-mediated courses had the largest percentages of students indicating that computers were used in every class. GC712 had the largest percentage of students (34%) choosing weekly usage of the computer. Suburban students had the greatest variance from expected values (by a factor of 1.19) for computer usage in every class. Only urban students had higher than expected values for computer usage weekly and occasionally. There was a significant difference from expected values in preference for the use of computers only by course number, $\chi^2(\text{df} = 12, n = 169) = 88.497, p = .000$. Perhaps unsurprisingly, variance in actual values and expected values for each course follow the course's design. GC721 and GC731 are primarily designed to be computer-free, and student preferences are only higher than expected values in the "never" responses. GC721 is designed for at least weekly computer usage, and actual counts for "weekly" varied the most from the expected value (14 vs. 7). GC722 and GC732 are computer-mediated courses, and students' actual values for preferring computer usage daily were above the expected value.

TABLE 10

Percent Response for Questions on Computer-Based Teaching by Course Number, SES, or Demographics, Fall 2003 ($N = 178$)

		Occurrence of computer-based teaching			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	7.9%	71.1%	18.4%	2.6%
721	25	8.0%	4.0%	8.0%	80.0%
722	25	88.0%	12.0%	0.0%	0.0%
731	69	1.4%	17.4%	15.9%	65.2%
732	14	100.0%	0.0%	0.0%	0.0%
Neighborhood					
Urban	78	7.9%	71.1%	18.4%	2.6%
Rural	25	8.0%	4.0%	8.0%	80.0%
Suburban	65	88.0%	12.0%	0.0%	0.0%

		Average hours per week using computer software					
Course number	*n*	Never	0–1	2–3	4–5	6–8	9 or more
712	38	7.9%	26.3%	39.5%	18.4%	0.0%	7.9%
721	26	76.9%	3.8%	7.7%	7.7%	3.8%	0.0%
722	25	0.0%	12.0%	32.0%	44.0%	0.0%	12.0%
731	69	68.1%	18.8%	2.9%	7.2%	1.4%	1.4%
732	14	7.1%	35.7%	28.6%	14.3%	7.1%	7.1%

		Computer software helped with course content				
Course number	*n*	Very much	Some	Very little	Not at all	NA
712	37	29.7%	28.9%	16.21%	0.0%	5.4%
721	26	7.7%	23.1%	0.0%	7.7%	73.1%
722	25	52.0%	36.0%	8.0%	4.0%	0.0%
731	68	1.5%	26.1%	7.4%	11.8%	63.2%
732	14	35.7%	21.4%	28.6%	0.0%	7.1%
Parents' education level						
College degree	77	20.8%	22.4%	9.1%	6.5%	51.9%
Voc/tech course work	32	12.5%	42.4%	9.4%	0.0%	40.6%
High school diploma	35	25.7%	36.4%	11.4%	11.4%	25.7%
Less than high school diploma	7	0.0%	71.4%	0.0%	28.6%	14.3%

		Preference for computer-based teaching			
Course number	*n*	Every class	Weekly	Occasionally	Never
712	38	23.7%	36.8%	23.7%	15.8%
721	26	7.7%	7.7%	30.8%	53.8%
722	24	8.3%	16.7%	12.5%	4.2%
731	67	10.1%	13.4%	25.4%	58.2%
732	14	7.1%	14.3%	14.3%	0.0%

Forty-two percent of the students reported never having used computer software while 36% used software three or less hours per week. Computer usage per week was also significantly different from expected values by course numbers, $\chi^2(\text{df} = 20, n = 172) = 103.161, p = .000$. Only GC712 and the computer-mediated courses had higher than expected values for computer use nine or more hours per week. Only GC721 and GC731 had higher than expected values for never using computer software for their mathematics course. This question had been asked over the 3-year period of this study, so the test of significance for differences over the years was also conducted and proved statistically significant, $\chi^2(\text{df} = 18, n = 987) = 68.302, p = .000$. Computer software usage has been increasing over the years.

Of the students who used the computer software, 27% stated that the software helped them very little or not at all in learning course content. The value of the computer software to learning course content was statistical significant by course number, $\chi^2(\text{df} = 16, n = 170) = 103.667, p = .000$, and parents' education, $\chi^2(\text{df} = 16, n = 172) = 36.149, p = .003$. GC712 and the computer-mediated courses (GC722 and GC732) had higher than expected values choosing "very much" when responding to "the computer software helped me to learn the content of the course." Students (51.9%) whose parents had a college degree chose not to enroll in computer-based courses compared to students (14.3%) whose parents had less then a high school diploma. Students (32.5%) whose parents had a college degree found the computer software at least somewhat helpful compared to students (57.1%) whose parents had less then a high school diploma. χ^2 analysis also revealed a significant difference in students' responses to this question by year, $\chi^2(\text{df} = 12, n = 173) = 8.315, p = .040$, showing a positive trend between 2001 and 2003 (see Table 6).

Math Center

The surveys conducted in mathematics classes between 2001 and 2003 have included questions regarding students' usage of the Math Center and students' levels of satisfaction when working there. The new 2003 survey included seven questions consistent with questions posed in prior years as well as a new question asking if students thought that the Math Center encouraged them to explore mathematics and to be independent learners, consistent with a key AMATYC recommendation. These surveys have been important sources of feedback prior to the Math Center's implementation of a system for collecting daily usage statistics (see Chapter 20). It should be noted that the Math Center also serves current and former GC students taking other mathematics courses that are not represented in this survey (i.e., statistics, college algebra, pre-calculus, calculus, and a variety of other mathematics and mathematics-related courses).

For the 2003 survey, 71% of the responding students reported having used resources in the Math Center, 24% of the students used the center's computers once or more during the semester, 18% visited the center to make up quizzes or exams, and 48% worked in the center alone as opposed to 14% working in groups. Of those who reported having used the Math Center, 68% indicated that they were at least a little more confident in mathematics as a result of having used the center, 37% said "some," and 17% said "very much." Of the students using the center, 62% reported that they were encouraged to explore and to be independent learners at least a little, 35% said "some," and 13% said "very much."

Discussion

The discussion, too, is organized into six sub-sections. We analyze the data with emphasis on tems from the survey that bear on the GC mission, our quest to embrace the diversity of our student population, and our desire to advance the professional standards for undergraduate mathematics education set by AMATYC and NCTM. We cite research literature to support our interpretations. This discussion is intended to be a guide for self-reflection and program review.

Population Demographics

There was almost a 30% drop in student participation between 2002 and 2003 on the GC Mathematics Program Questionnaire. We attribute this drop in participation to the change in the survey format. We stopped using bubble sheets to collect data and moved to an online survey. Student participation in courses that had computers within their classrooms had response rates similar to the 2001 and 2002 questionnaire rates. Only courses that did not have at least weekly class sessions in a computer classroom had low response rates (18% and 31%). We will explore delivering the survey using both methods in the future to optimize participation.

The first time that we had sufficient data to determine that the introductory algebra courses have more first-generation college students and more urban students was in 2003. The intermediate algebra courses have more suburban and rural students. It is also evident that the developmental mathematics courses have more female students than the overall GC population. These are important factors to reflect on as we (a) prepare information for advisors, (b) review and revise mathematics placement criteria and tests, and (c) consider and prepare alternative formats for offering the developmental mathematics curriculum. First-generation, urban, and female students who begin their mathematics trajectories within the lowest-level developmental courses face a longer course sequence to satisfy college requirements for graduation than their male, suburban or rural, and non-first-generation peers who begin in the higher-level developmental mathematics courses. Is this creating another barrier to graduation for populations that have been traditionally underrepresented in STEM subject areas? Are we tracking certain students into GC712 or other introductory algebra courses rather than encouraging students to begin at the intermediate algebra level? Do our placement test items give an advantage to suburban, non-first-generation students? While we consider the possibility of hidden forms of discrimination embedded in our placement, counseling, and curricular practices, our teaching faculty are increasingly emphasizing multicultural pedagogies in our teaching and tutor-training (Duranczyk et al., 2004; Frisch, 2004; Opitz, 2003).

Thirty-seven percent of the students did not answer the question regarding family income. All other SES questions had less than 10% missing responses, and many had 2% or less missing responses. In subsequent studies we plan to gather student data on parental income, ethnic or racial identities, and performance or course outcome through the University's Office of Institutional Research and Reporting and correlate the information with students' responses by a coding system in order to ensure that demographic data will ultimately be anonymous.

Mission

The four questions on the survey geared toward evaluating the mathematics program's ability to meet the GC mission indicate that more than 55% of the respondents believe that we are successful. The two questions specifically addressing mathematics instruction are the strongest: 83.2% agree class sizes are appropriate for personalized attention, and 70.3% agree that mathematics strategies and study skills are taught. GC's mission is to provide access to the University of Minnesota for highly motivated students from a broad range of backgrounds. Beyond mathematics skills and mathematics study skills, students must also feel enabled to learn more about how to succeed in the university setting and set attainable academic and career goals while in GC. These two areas have the lowest proportion of students agreeing that they are enabled. More than 25% had no opinion on these two questions. Does this finding indicate that students are not seeing the connection between these two goals and their mathematics classes? Could we assume that we are doing no harm in these areas, but we are also not adequately addressing these concerns? This is an area for improvement. When we look at the statistically significant dependencies among questions regarding the class size and parents' highest level of educational attainment, there is a flag raised when we see that our first-generation college students (37.5%) have no opinion regarding appropriate class size. Could this indicate that the courses may not be conducive for personalized attention for many of these students, but that they are unsure if this is due to class size? These students do not have preconceptions or knowledge of helpful college class sizes derived from family experience; they are first-generation college students. We are also concerned that a higher percentage (39.9% versus 11.5%) of our lower income students (i.e., with less than $45,000 family income) indicated that they do not feel enabled by our classes in setting attainable academic and career goals, indicating another area for improvement in our program.

Intellectual Development

When evaluating the effectiveness of the GC mathematics program in meeting the intellectual development standards of AMATYC (i.e., modelling, reasoning, connecting, communicating, using technology, developing power), the percentage of students preferring at least weekly activities involving these developmental skills is greater than the percentage of students reporting at least weekly occurrence of these activities. This may indicate that students would appreciate it if we incorporate more of the other intellectual development skills at least weekly in our classes. In classes where more than 50% of the students were at most somewhat engaged in the intellectual development opportunities, more than 20% of the students requested that these activities never occur in class. Can we then say that when intellectual development activities occur and they are not highly or moderately engaging, students are more apt to suggest that the activity be eliminated from the curriculum? Interviews with students and faculty discussions may help further illuminate this issue. Amarasinghe (2000) had students complete a survey questionnaire on attitudes and beliefs and assessed responses against AMATYC standards for intellectual development. She followed up this survey by interviewing a few randomly selected students representing each class. For our study, adding individual interviews or a focus group from each class could help in the interpretation of our survey data.

A high percentage of students reported only occasional or no occurrence of activities that (a) made connections between mathematics, other areas of human culture and other disciplines (63%); (b) encouraged reading and writing about mathematics (65%); and (c) encouraged the discussion of mathematics (65%). The dearth of activities that made connections between math, other areas of human culture, and other disciplines was statistically dependent on course number. The computer-mediated courses had the lowest proportion of students reporting the occurrence of activities connecting mathematics with culture or other academic disciplines. If we are committed to increasing cross-disciplinary and cross-cultural activities, we may need to supplement the computer-mediated curriculum. Beyond significant dependence between the communication of mathematics and course numbers, there was a significant dependence between the level of engagement and preference for activities encouraging the discussion of mathematics and students' neighborhoods of upbringing. A larger percentage of urban students were more engaged and preferred activities encouraging the discussion of mathematics. Would increasing discussion activities in mathematics courses increase the retention and engagement of urban students and keep the STEM pipeline open for urban students?

In the areas of appropriate technology, in courses that used more technology, students were more engaged and preferred its use. In courses that only occasionally used technology, students reported being less engaged and had the lowest preference for its use. These results raise two questions. First, have students chosen courses to meet their preferred learning styles and preferences regarding the use of technology? Second, is the level of preference and the level of engagement related to the level of exposure within the classroom to the use of technology? First-generation college students and students from families with an income below $45,000 had a greater preference for the use of technology. Could one assume that first-generation students and lower-income students are less bombarded with technology in their daily lives and therefore have more engagement or preference for its use in the classroom? Could one assume that some groups of students just prefer the use of technology over other methods of instruction because (a) it allows them to learn the course material without having to rely on traditional communication techniques that may pose impediments for students who speak English as a second language or urban students who choose not or have not embraced "dominant" culture discourse or (b) nontraditional-age students coming back to school feel a social stigma in classrooms dominated by traditional-age students?

In summary, the survey results suggest that we can improve our curriculum to meet the AMATYC standards for intellectual development. Having this information about the occurrence, preference, and engagement of students in intellectual development activities within the mathematics classroom will help guide us in developing our program. Knowing that some of the SES groups that are most vulnerable in the mathematics pipeline (e.g., women, first-generation college students, low-income students, and urban students) and have an interest and high level of engagement in specific areas of intellectual development can help us to create more effective classroom environments to meet their needs and encourage their growth in mathematics and mathematics-based careers.

Content

During the 2002–2003 academic year, the GC mathematics faculty spent considerable time and effort evaluating and revamping course content in beginning and intermediate algebra. The impetus for this change began in fall 2002 as we negotiated teaching one section of college algebra within GC and as we identified areas within the GC developmental mathematics curriculum that could use improvement. Faculty were aware of the shortcomings of using a common text (Academic Systems Corporation, 1999a, 1999b) for introductory and intermediate algebra sections. As we studied the college algebra curriculum it became more apparent that we also needed to make changes in the course content and level of rigor of our developmental mathematics courses to promote retention beyond transfer to degree-granting colleges of the University. The results of our 3-year study indicate that students are responding more positively in 2003 than in previous years to changes in course content and delivery methods. We observed statistically significant results in three areas:

1. There have been significant increases in reporting the occurrence of new topics at least weekly in the courses. In 2003 over 62% of the students reported seeing new material at least weekly compared to fewer than 35% of the students reporting such in 2001. We attribute this to our adoption of new textbooks in 2003 and appropriate placement. But the variation in responses by income groups surprised us. More students from poverty-level families reported only occasionally seeing new material, whereas students from the highest income group reported seeing new material more often. Could it be that students from the highest income groups were exposed to less mathematics content in high school? To better understand students' precollegiate preparation, which we expect depends on their urban and suburban school systems, we will consider students' high school backgrounds in future studies.

2. There were larger proportions of students reporting appropriate placement and smaller percentages of students reporting a low placement. The greatest shift was between 2002 and 2003. Students reporting too low a placement moved from 49% (2001) and 45% (2002) to only 14% (2003). With the addition of rigor into the courses more students are recognizing an appropriate placement. It is important for students to recognize that they are being challenged and prepared for higher-level mathematics and mathematics-based course work. Armstrong (2000) reported, from a quantitative study of community college mathematics students examining the predictive validity of placement test scores, that student disposition and demographic variables had more explanatory power than did other variables, including test scores:

> The interaction of student traits, instructional treatments, and instructor practices may have a greater effect on student performance than the skills measured by assessment tests. Poor prediction of performance or misclassification of students is thus exacerbated when the criterion for student success can vary depending on the class in which a student enrolls. A major finding of this study is that educational standards are maintained by the college, not determined by the entering ability of its students. (p. 691)

GC does have a mandatory mathematics placement test, but the results of the test are advisory. Armstrong's research supports this policy. GC advisors consider students' placement test results along with their mathematics history, academic habits of mind, and level of confidence.

3. In our survey, more than 69% of the students reported positively that their classes helped them to *feel more competent* in skills areas. This is an important step for continued growth and development in mathematics. Increased confidence begets increased achievement (Stage & Kloosterman, 1995). We need to move forward with adapting and refining this survey tool and complement it with students' achievement data in developmental and college-level mathematics course work to be able to add to the growing body of research linking affective factors and student achievement.

Pedagogy

The standards for pedagogy adopted by AMATYC (Cohen, 1995) and NCTM (2000) that we queried via the student questionnaires involve a range of approaches to stimulate student involvement with and understanding of mathematics concepts. This area of the questionnaire also had the most variability by course number, SES, and other demographic variables. There were no questions on the previous questionnaires soliciting information regarding students' experiences and preferences in pedagogy, so we are unable to evaluate whether the changes in teaching faculty, course content, or textbooks have impacted pedagogy. This will be an area in which we will continue to collect information to determine our progress toward AMATYC standards.

Preferred pedagogy is definitely impacted by students' SES and other demographic variables. The literature generally supports these findings (Secada, 1992, 1996; Stanic, 1991; Tate, 1995, 1997; Woodson, 1990). Secada, Stanic, and Woodson noted that the presentation of abstract and disconnected mathematical facts does not empower disenfranchised students. NCTM's (1991) *Professional Standards for Teaching Mathematics* called for mathematics pedagogy that builds on understanding of how students' linguistic, ethnic, racial, gender, and socioeconomic backgrounds influence their learning.

The greatest percentage of students preferred and experienced activities encouraging them to think independently and explore mathematics at least weekly (61%). Over 64% of the students indicated that their class never worked collaboratively in groups on activities, yet only 36% of the students indicated that they preferred no collaborative activities. There is a growing body of literature and research indicating that collaborative group work helps students learn and retain more content information than any other instructional format while increasing their satisfaction with their classes (Beckman, 1990; Chickering & Gamson, 1991: Cooper, 1990; Goodsell, Maher, & Tinto, 1992; Johnson, Johnson, & Smith, 1991; Leapard, 2001; Thomas & Higbee, 1996; Triesman, 1986).

The Math Center

In addition to academic classroom services, successful developmental programs provided learning support services that included tutoring, lab assistance, counseling, advising, and other services designed to eliminate barriers to learning identified by the students (Gibbs, 1994). Research by Boylan and Saxon (1998), Kulik, Kulik, and Schwalb (1983), McCabe and Day (1998), Roueche, Baker, and Roueche, (1984), and Starks (1989) indicated that comprehensive learning support systems are positively correlated with student success. Although our survey results in the area of GC Math Center usage show promising trends, we still need to look at how students' use of the Math Center correlates with their levels of competence and achievement.

Summary

The questionnaire could be enhanced by adding a modified version to collect faculty data. Faculty data would include: (a) personal goals, as they relate to the AMATYC standards and GC mission, for intellectual development, content, and pedagogy within developmental mathematics courses; (b) personal assessment of how effectively intellectual development, content, and pedagogy goals were implemented; and (c) personal assessment of students' engagement in course activities.

Recommendations for Further Research

As we look forward to annual data from our students on how they perceive our mathematics curriculum and how confident they feel after having taken our courses, we will obtain a better sense of the trends. From our 2003 analysis of student responses by course number and SES demographics, we have discovered that in some cases students resist precisely those approaches that emphasize interactive classroom methods while indicating a preference for traditional lecture methods. At the same time, in other cases students' use of computers has increased over prior years, and their preferences for computer-mediated instruction has not waned. Do the patterns in students' responses follow precisely those classroom environments with which they are most familiar? Do their responses beckon for keeping the status quo or moving our mathematics curriculum further in the direction of reform pedagogies? To what extent should we heed students' views on pedagogy?

Overall, students do express a desire to engage in problem-solving activities and to see the relevance of mathematical concepts to real-life situations. Moreover, the high proportion of women students in our developmental mathematics classes and the high proportion of first-generation, urban students taking our most elementary introductory algebra course suggest the further work we must do to promote the success of precisely those populations underrepresented in STEM careers.

Assessment of a mathematics program cannot rest solely on students' perceptions. This important source of information must be correlated with grades, retention statistics, faculty perceptions, and comparative data from comparable developmental mathematics programs at other institutions. Internal thermostats may help guide our program development, but external comparisons will help us judge our effectiveness in relation to peer institutions. National surveys such as Kull's (1999) point us toward this direction.

We encourage developmental mathematics educators at other institutions to engage in similar assessments of their programs comparing AMATYC standards and students' perceptions of mathematics content and pedagogy. We hope this chapter invites comparative studies between institutions that reflect the distinctiveness of individual programs, identify common challenges, and guide us toward increased retention, graduation, access, and equity for students' pursuing STEM careers regardless of race, gender, income, environment, or parents' educational background.

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CHAPTER 24

Student Perceptions of General College: A Student-Initiated Study

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ABSTRACT

Within this chapter we report on the results of a survey constructed by former General College (GC) students Ian Haberman and Joshua Schmitt, in consultation with 2003–2004 GC Student Board Advisor Mark Bellcourt, to explore the perceptions of GC students regarding their satisfaction with their decision to attend the University of Minnesota, their admission to the General College, diversity within the University and GC, their level of preparation for college, and other factors. GC is the most racially, economically, socially, and academically diverse unit on campus, and the perceptions of GC's students are probably as individual as the students themselves. That hypothesis is supported by the findings of this research.

Within this chapter we will explore General College (GC) through the eyes of the students. We will examine the results of a survey by GC students regarding their perceptions of GC and the University. However, first it is important to recognize that GC does have the most racially, economically, socially, and academically diverse students on campus. High school rank for new students admitted to GC in 2004 ranged from the 2nd to the 99th percentile, ACT composite scores ranged from 11 to 31, and ages ranged from 17 to 52 years of age. Racially, about 49% identify as Anglo, just under 20% as Asian American, almost 22% as African American, more than 4% as Chicano/Latino, and just over 2% as American Indian, with information missing for 3% of GC students (*Facts and Figures*, 2004).

Before discussing the results of the survey on student perceptions, we need to establish the context of this discussion. Although General College has a long and rich history with the University of Minnesota, it has struggled with its identity, especially since Ken Keller's "Commitment to Focus" plan was unveiled in 1985 (Berman & Pflaum, 2001). The idea was to take away degree-granting status from GC and to focus the college's commitment on developmental courses. Keller's successor, Nils Hasselmo, took it one step further and in 1996 proposed to close GC completely. However, the Board of Regents rejected that proposal because of the University's commitment to providing access for students of color and other underrepresented groups (Berman & Pflaum). Berman and Pflaum further suggested that access and excellence have not always been considered compatible goals. Recently this debate arose again, and on June 10, 2005, the University of Minnesota Board of Regents voted to close the General College while retaining some of its functions as a department in the College of Education and Human Development.

The General College has endeavored to explore whether it is possible to achieve access and excellence at the same time. The concern of the authors of this chapter is that the student perception of GC is one of access, not excellence, and that this perception assists in forming a stereotype of the General College that is then shared by external constituencies and the public at large as well. This image of the General College is characterized by comments like:

"GC is for stupid people."

"GC is for the jocks."

"GC is for 'foreigners' who can't speak English."

"Only students who couldn't make it in other colleges of the University are admitted into GC."

Within the next few pages, we will report the results of a survey of student perceptions about GC and the University (Bellcourt, Haberman, & Schmitt, 2004).

Method

In the spring of 2004, the General College Student Board (GCSB) sponsored an online survey (Haberman, Schmitt, & Bellcourt, 2004) to explore the diverse social and academic perceptions that GC students had about themselves, GC, and the University. A team of students and staff reviewed potential survey items for face validity. The final survey consisted of 26 Likert-type scale items regarding student perceptions of GC and the University. Students responded on a five-point scale for which 1 represented strongly disagree and 5 indicated strongly agree (Haberman, Schmitt, & Bellcourt).

The General College Student Board extended invitations via e-mail and through classroom announcements to all GC students to participate in this voluntary online survey. More than 230 students, representing just over 15% of the GC student body, responded to the survey. The results cannot be widely generalized to the whole GC student body because of the low response rate and the factors that might have influenced the self-selection of participants.

Results

For all 26 items the responses ranged from 1 (i.e., strongly disagree) to 5 (strongly agree). Item means ranged from 1.96 for one of the negatively-stated items ("I feel that the U of MN Twin Cities Campus is too large for me") to 4.06 for the comparable positively-stated item ("I am comfortable with the size of the U of MN Twin Cities Campus"). Thus, none of the means were particularly high or low. Meanwhile, standard deviations for the 26 items ranged from 0.922 to 1.390, so there was quite a bit of variability among responses for each item.

A factor analysis of the data identified seven factors around which the variables tended to cluster, whether negatively or positively. The researchers (Bellcourt, Haberman, & Schmitt, 2004) explored the items within each cluster and identified their common characteristics and themes. The following paragraphs summarize the results of the survey by grouping items in those clusters.

As indicated in Table 1, the responding students were generally satisfied with their decision to attend the University of Minnesota ($M = 3.98$). They reported feeling comfortable with the size of the campus ($M = 4.06$) and somewhat agreed ($M = 3.53$) that they felt like a part of the University community.

Table 2 reports on other variables related to sense of satisfaction with the University. Participating students generally believed that the University of Minnesota's educational philosophy reflected their own ($M = 3.53$). They somewhat agreed that the University is interested in their well being ($M = 3.29$). Also included in this set of items was "I believe that only those who cannot get admitted to another college at the U of MN Twin Cities Campus are admitted to General College" ($M = 3.53$).

TABLE 1
Means, Standard Deviations, and Factor Loadings for Factor 1 Items: Sense of Comfort With GC

Variable	*N*	*M*	*SD*	Loading
I feel that the U of MN Twin Cities Campus is too large for me.	225	1.96	.958	-.812
I am comfortable with the size of the U of MN Twin Cities Campus.	229	4.06	.923	.809
I am satisfied that I chose to attend the U of MN.	228	3.98	1.076	.602
I feel like a part of the U of MN Twin Cities Campus community.	229	3.53	1.049	.550

TABLE 2
Means, Standard Deviations, and Factor Loadings for Factor 2 Items:
Sense of Satisfaction With the University

Variable	*N*	*M*	*SD*	Loading
I believe that the overall educational philosophy of the U of MN reflects my own philosophy well.	231	3.53	.922	.639
I believe that only those who cannot get admitted to another college at the U of MN Twin Cities Campus are admitted to General College.	231	3.53	1.167	-.525
The U of MN is interested in my well-being.	231	3.29	1.012	.477

TABLE 3
Means, Standard Deviations, and Factor Loadings for Factor 3 Items:
Sense of Satisfaction With Diversity on Campus

Variable	*N*	*M*	*SD*	Loading
I believe there is more student diversity in the General College than in the entire U of MN Twin Cities Campus.	230	3.89	1.064	-.702
I believe the U of MN Twin Cities Campus has a diverse student population.	227	4.0	1.173	.652
I would have rather attended a different institution than the U of MN.	231	2.29	1.221	-.520

The next set of items is related to diversity within the General College and the University as a whole. As indicated in Table 3, the students responding to the survey agreed that the University of Minnesota's Twin Cities campus "has a diverse student population" ($M = 4.00$) and also thought "there is more student diversity in the General College than in the entire U of MN Twin Cities Campus" ($M = 3.89$).

Table 4 presents items regarding students' perceptions about the General College. With a range of responses from 1 to 5, standard deviations from 0.974 to 1.332, and means ranging from 2.57 to 3.52, none of the items for this factor were very conclusive. With means hovering near 3 on the five-point scale, on the average students neither agreed nor disagreed that they (a) "take pride in being in General College" ($M = 2.82$), (b) are "embarrassed to tell others" that they are in GC ($M = 3.05$), (c) "feel like a part of the General College community" ($M = 2.99$), or (d) "feel the student leadership of the General College is helpful and effective" ($M = 2.95$). Students did disagree somewhat with the statement that "I am uncomfortable or do not connect well to the other students in the General College" ($M = 2.57$) and agreed somewhat that they "would rather be in one of the other colleges" of the University ($M = 3.50$). They also agreed somewhat in their belief that GC's student body "is comprised mostly of students of color" ($M = 3.52$). In reality GC has a much larger proportion of students of color than any other college of the University of Minnesota, but Caucasian students still make up the majority.

The fifth factor identified by the factor analysis (Bellcourt, Haberman, & Schmitt, 2004) and reported in Table 5 is a sense of academic preparedness. On average, students agreed somewhat with the positively-stated items, "I felt very prepared for college" ($M = 3.37$) and "to take college-level courses" ($M = 3.61$) and somewhat disagreed or were noncommittal about the negatively-stated items, "I did not feel like my high school adequately prepared me for college" ($M = 2.72$) and "I was afraid that I would not do well in my college-level classes" ($M = 2.98$). Again, with standard deviations for these items ranging from 0.967 to 1.265, there is a fair amount of variation in student perspectives.

TABLE 4

Means, Standard Deviations, and Factor Loadings for Factor 4 Items: Sense of Comfort With GC

Variable	*N*	*M*	*SD*	Loading
I take pride in being in General College.	231	2.82	1.179	-.820
I am embarrassed to tell others that I am in General College.	229	3.05	1.332	.785
I feel like a part of the General College community.	230	2.99	1.146	-.771
I would rather be in one of the other colleges at the U of MN	228	3.50	1.329	.762
I am uncomfortable or do not connect well to the other students in General College.	229	2.57	1.076	.693
I feel the student leadership of General College is helpful and effective.	230	2.95	.974	-.558
I believe the student body of General College is comprised mostly of students of color.	231	3.52	1.145	.420

TABLE 5

Means, Standard Deviations, and Factor Loadings for Factor 5 Items: Sense of Academic Preparedness

Variable	*N*	*M*	*SD*	Loading
I felt very prepared for college.	231	3.37	.973	.816
I felt very prepared to take college-level courses.	228	3.61	.957	.782
I was afraid I would not do well in my college-level classes.	230	2.98	1.217	-.684
I did not feel like my high school adequately prepared me for college.	231	2.72	1.265	-.615

TABLE 6

Means, Standard Deviations, and Factor Loadings for Factor 6 Items: Making use of Opportunities for Leadership

Variable	*N*	*M*	*SD*	Loading
I am aware of General College student leadership opportunities.	230	3.04	1.059	.755
If I chose to, I believe I could be involved in leadership positions.	231	3.63	.964	.719
I took college prep courses in high school.	231	3.05	1.390	.337

The sixth factor, consisting of only two items, dealt with other steps students might take to prepare themselves for college. The mean response to "I talked with college students about their experiences before choosing a college" was 2.94 ($SD = 1.093$). The other item asked whether students considered New Student Orientation to be helpful ($M = 3.30$, $SD = 1.132$).

The final factor, presented in Table 6, was related to students making use of leadership opportunities. At 3.05 the mean for "I took college prep courses in high school" fell almost exactly at the middle of the five-point range of answers. Students were as likely as not to be aware of General College student leadership opportunities ($M = 3.04$) and somewhat agreed that if they chose to they "could be involved in leadership positions" ($M = 3.63$).

Discussion

As previously noted by Berman and Pflaum (2001), the concepts of access and excellence seem to be perceived by many to be mutually exclusive. The results of this survey suggest that students have mixed views about gaining access to the University via admission to the General College, rather than having pride in GC as a college characterized by excellence in teaching and learning. Some students said they were embarrassed to be in GC, do not feel comfortable with other students in GC, and do not feel like a part of the GC community. Yet, the students were relatively positive on most of the questions related to their experience and perceptions of the University as a whole. Although we did not ask students any opened-ended questions about why they might feel embarrassed to be in GC, anecdotally during new student orientation and individual advising appointments and from student stories presented in Chapter 2, we have gleaned a widely-held perception that GC is somehow "less than" the rest of the University. For example, a number of students reported that their parents and friends were disappointed in them because they were not admitted to another college at the University.

The data, however, did present some perplexing contradictions, especially with questions surrounding diversity. Students who responded to the survey perceived that the University of Minnesota has a diverse student population. In reality, the overall undergraduate student body at the University is not particularly diverse, but it might be anticipated that students enrolled in General College courses would consider the University diverse because of their own classroom experiences. Meanwhile, participating students thought that GC "is comprised mostly of students of color," which is not true, but compared to the University as a whole it is not surprising that it might seem that way. Also, in the factor analysis questions regarding diversity did not tend to cluster as one might expect. For example, the question regarding students of color in GC was positively aligned with students not feeling comfortable in GC and the desire to be in other units at the University. Also, the item about students preferring to attend other institutions negatively aligned with the item regarding the diversity on the University campus. The researchers (Haberman, Schmitt, & Bellcourt, 2004) did not collect demographic information on the students who responded to the survey, so it is impossible to draw specific conclusions, but it appears that a number of the respondents either do not understand or simply do not appreciate diversity and its contributions to the undergraduate experience.

This research has only begun to scratch the surface regarding student perceptions of GC. Future research using qualitative methods is needed to gain a better understanding of the reasons why some students perceive GC as less than or inferior to the rest of the University. Also, this research, like the Multicultural Awareness Project for Institutional Transformation (MAP IT) pilot study presented in Chapter 7, raises some serious questions regarding student perceptions of diversity. Future research needs to explore the implications of diversity within GC.

Conclusion

This chapter should not be viewed as a negative reflection on GC, but rather a reality check of perceptions about GC. As noted in the introduction of this chapter, General College does have a long and rich history at the University of Minnesota. However, the achievements of faculty, staff, and students have been and continue to be overlooked by many administrators, government officials, and the general public. There does seem to be the perception by students and the general public that GC is more concerned with access for underrepresented groups and less concerned with academic excellence.

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CHAPTER 25

Pre- and Post-Admission Predictors of the Academic Success of Developmental Education Students

Randy Moore

ABSTRACT

Traditional pre-admission criteria used to measure the academic aptitude of first-year college students (i.e., ACT scores, high school graduation percentile rank) are poor predictors of the academic success of developmental education students in General College. The behaviors that do accurately predict the academic success of students in General College (e.g., class attendance, engagement in course-related activities) are explicit expressions of students' academic motivation, and it is this motivation that is critical for students' success in GC. These results are discussed relative to recommendations for helping developmental education students succeed in college.

General College (GC) provides access for a diverse group of developmental education students to degree-granting colleges at the University of Minnesota. Students admitted to GC typically include disproportionate numbers of urban students, first-generation college students, students who are parents, students with disabilities, students of color, older students, and non-native speakers of English. To help these students succeed, GC provides a variety of centralized and accessible support services that are described in previous chapters, including a Transfer and Career Center, Academic Resource Center, Student Parent HELP Center, TRIO/Student Support Services, and the Commanding English Program. These resources are supplemented by an aggressive advising system and excellent teachers who are expected to offer rigorous, credit-bearing, up-to-date, and inclusive courses that include a variety of pedagogical approaches to accommodate our students' diverse learning styles. Together, these resources and individuals create a nurturing and challenging academic environment in which students can learn the academic skills and earn the course credits necessary to transfer to one of the university's many degree-granting colleges.

GC would like to give all underprepared students access to its programs, faculty, and support services. However, GC's limited resources allow it to enroll only about 20% of its applicants; for example, in the fall of 2003, GC enrolled 894 of its 4,953 applicants, which was approximately 17% of the University's incoming class (*About General College*, 2003). The fact that GC can enroll so few of its applicants magnifies the importance of its admissions decisions; GC must admit the students who are most likely to succeed. How can GC select students who have the best chances of eventually graduating from the university? That is, what traits predict the academic success of students in GC?

In this chapter I document the accuracy of various pre- and post-admission predictors of the academic success of developmental education students in GC. Students' academic performances are influenced by many factors (e.g., academic preparation, cultural background, academic and social maturity, and socioeconomic status), yet most studies of these factors have focused on characteristics that are not directly related to students' course-related behaviors, such as institutional commitment, personality traits, hours worked by students each week, and whether the student or others pay for the student's education (Cabrera, Nora, & Castañeda, 1993; Devadoss & Foltz, 1996; Friedman, Rodriguez, & McComb, 2001; Tinto, 1975). Here I focus on some measures and behaviors that can be accurately and objectively quantified, such as students' grades, attendance, test scores, and high school graduation percentiles. I have avoided self-reported data such as students' claims about time spent studying for exams and reading the course textbook; studies in GC (Moore, in press-a) and elsewhere (Sappington, Kinsey, & Munsayac, 2002) have shown that such data are often misleading.

A Brief Profile of GC Students

In the fall of 2003, GC's students had an average high school graduation percentile rank of 53 (range = 1–99), an average age of 19 (range = 16–50), and an average composite ACT score of 20 (range = 10–32). GC enrolls approximately equal percentages of men and women who are ethnically diverse: 20% African American, 2% American Indian, 51% Anglo, 20% Asian American, 4% Chicano/Latino, and 3% undeclared (*About General College*, 2003). These students earned an average first-semester grade point average (GPA) of 2.8, an average second-semester GPA of 2.6, and an average first-year GPA of 2.7. Approximately 18% of GC's first-year students end their first year of college with GPAs less than 2.0, 40% end their first year of college with GPAs between 2.0 and 3.0, and 42% end their first year of college with GPAs above 3.0 (Moore, in press-b).

The Academic Crystal Ball: What Criteria Predict Success?

To determine the factors that predict the success of developmental education students in GC, I measured a variety of pre-admission and post-admission criteria that could be measured easily and accurately.

Pre-Admission Criteria

The pre-admission criteria that I measured were students' academic aptitude ratings and their participation in a summer orientation program.

Academic aptitude rating (AAR). Many colleges and universities use students' academic performance in high school (e.g., their class rank or high school GPA), their scores on aptitude tests (e.g., ACT, SAT), or a combination of these factors as a basis for admission and placement in developmental education courses (Ray, Garavalia, & Murdock, 2003). Some studies have reported that students' high school grades and SAT or ACT scores accurately predict students' college grades (Neal, Schaer, Ley, & Wright, 1990; Petrie & Stoever, 1997), whereas others have reported low or no correlation between these scores and students' academic performance in college (Britton & Tesser, 1991; Côté & Levine, 2000; Meeker, Fox, & Whitley, 1994; Thomas & Higbee, 2000). However, virtually none of these studies have focused on developmental education students, who often have personal characteristics (e.g., test anxiety, fear of failure) that distinguish them from regular-admission students (Larose & Roy, 1991; Morrison, 1999).

The University of Minnesota combines a student's ACT score and high school graduation percentile rank to create the student's Academic Aptitude Rating, which equals the student's high school graduation percentile plus two-times the students' ACT composite score. Some colleges at the University of Minnesota use AAR scores as requirements for admission; for example, the College of Liberal Arts requires AAR scores of at least 110 for regular admission, and the Institute of Technology guarantees admission to students having an AAR score of at least 135 (*Advising Manual*, 2004; *Undergraduate Catalog*, 2004). Although GC bases its admissions decisions on individual reviews of a variety of factors (e.g., family history, diversity), it also tracks students' AAR scores. For example, students who entered GC in the fall of 2003 had an average AAR of 93 (*About General College*, 2003).

As Brothen and Wambach (2003) have noted, "the important question about standardized academic aptitude and achievement tests is whether or not they accurately predict college performance for all students who take them" (p. 45). To answer this question, I measured how the AAR scores of GC's first-year students relate to their first-semester GPAs. For the entire entering classes in the fall of 2002 and 2003, the correlation of AAR scores and students' first-semester GPAs was very weak (r [646] = 0.10 for fall, 2002; r [721] = 0.14 for fall, 2003; see Figure 1). Indeed, for each group of students, variability in students' AAR scores accounted for less than 2% of the variability in students' first-semester and first-year GPAs (Moore, in press-b). These results are consistent with those of others (Cloud, 2001; Langley, Wambach, Brothen, & Madyun, in press; Moore, Jensen, Hsu, & Hatch, 2002; Ray, Garavalia, & Murdock, 2003; Snyder, Hackett, Stewart, & Smith, 2003; Thomas & Higbee, 2000) and indicate that AAR scores (i.e., ACT composite scores and high school graduation percentiles) do not accurately predict the academic success of developmental education students in GC. These results are not consistent with the claim that standardized academic aptitude and achievement tests are effective for identifying the college potential of developmental education students (Brothen & Wambach, 2003).

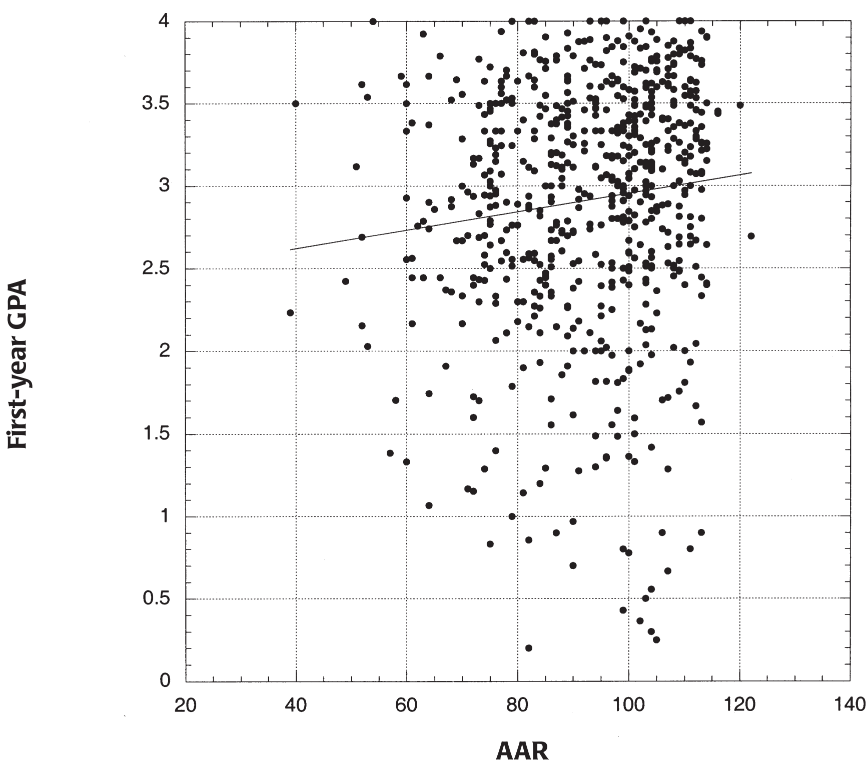

Figure 1. The association of AAR scores and first-year GPAs of GC students at the University of Minnesota. The equation for these data is $y = 2.40 + 0.006x$, and the correlation coefficient is 0.11.

Participation in a summer orientation program. GC requires all of its incoming students to attend a summer orientation program, at which they register for classes, learn about the university's academic policies, and meet their academic advisors. Although students select the dates and times of the orientation they would like to attend, in 2003 approximately 12% (N = 108) of the students neither attended nor made any effort to reschedule their orientation. These students were subsequently contacted by GC, after which many of them again did not attend or make any effort to reschedule the orientation that they had agreed to attend. These students finally attended an orientation only after being given an ultimatum to either attend a specially scheduled orientation or forfeit their admission into GC. Although these students knew that the orientation was important for their academic success at the university, they nevertheless were either not motivated enough to voluntarily attend the orientation, or faced other barriers to attending the orientation. Furthermore, they lacked the maturity or responsibility to contact GC if they were unable to attend the orientation. This lack of motivation or existence of other barriers was strongly associated with academic problems. For example, after their first year in college, these students (i.e., those who had to be forced to attend the summer orientation program) earned an average GPA of 2.1 and had a 32% chance of being placed on academic probation (i.e., having a GPA less than 2.0) after their first semester of college. For comparison, GC's other first-year students (i.e., those who voluntarily attended the summer orientation) earned an average first-year GPA of 2.8 and had only an 11% chance of being placed on academic probation after their first semester of college (Moore, in press-b). Although there were no significant differences in the AAR scores of students in these two groups, the differences in their subsequent GPAs and probabilities of being placed on academic probation were statistically significant ($p < 0.01$; Moore, in press-b).

Post-Admission Criteria

The post-admission criteria that I measured were students' class attendance, students' involvement in course-related activities, and students' first-semester and first-year GPAs.

Class attendance. Previous studies of the importance of class attendance for academic success have been inconclusive. Some studies have reported that class attendance correlates positively with high grades (Brocato, 1989; Grisé & Kenney, 2003; Jones, 1984; Launius, 1997; Thomas & Higbee, 2000), whereas other studies have reported that class attendance is unrelated to students' academic success (Berenson, Carter, & Norwood, 1992; Borland & Howsen, 1998). In light of this, it is not surprising that college instructors have a variety of attitudes and policies regarding class attendance. As Druger (2003) has noted, "Some instructors don't care if students attend class at all . . . [whereas] other instructors feel strongly about the importance of class attendance. Some instructors check attendance at every class; others don't check it at all" (p. 350).

First-year students are often apathetic about academic behaviors such as class attendance. For example, several studies (McGuire, 2003; Moore, 2003a, 2003b) have reported that absenteeism in introductory classes often approaches 50%, and Friedman, Rodriguez, and McComb (2001) reported that "25 percent or more [of] students are absent from classes on any given day" (p. 124). Similarly, Romer (1993) reported that absenteeism is "rampant" and that "about one-third of [first-year] students are not in class" (p. 167), concluding that "A generation ago, both in principle and in practice, attendance at class was not optional. Today, often in principle and almost always in practice, it is" (p. 174). Students' apathy and high rates of absenteeism do not change the fact that it is difficult for instructors, advisors, or others to help students who do not attend class. As Thomas & Higbee (2000) have noted, "The best . . . teacher, no matter how intellectually stimulating, no matter how clear in providing explanations and examples, may not be able to reach the high risk freshman who has no real interest in learning . . . and will certainly not be successful with the student who fails to show up for class" (p. 231).

In GC, many students express their lack of academic motivation by skipping class, not attending help sessions, rarely if ever visiting with their instructors during office hours, missing deadlines, not studying, not complying with assignments, and refusing to attend summer orientation programs (Moore, 2003a, 2003b). These behaviors are associated with lowered levels of motivation, for which there are predictable consequences. Indeed, the strongest predictor of GC students' academic success is class attendance: Students who attend class regularly have a much greater chance of earning high grades than do students who miss lots of classes (Moore, 2003a, 2003b). This correlation is statistically significant (r [1,486] = 0.79, $p < 0.01$; see Figure 2) and occurs in a variety of courses in which students get no points for attending class (Moore, 2003a, 2003b; Moore, Jensen, Hatch, Duranczyk, Staats, & Koch, 2003). Variability in students' attendance rates, which are unrelated to students' gender or ethnicity, accounted for more than 60% of the variability in students' grades in some courses in GC (Moore, 2003a, 2003b; Moore et al., 2003). Similar correlations of class attendance and course performance have been reported previously by others (e.g., Street, 1975; Wiley, 1992).

Of course, high rates of class attendance do not guarantee high grades; some students do well despite the fact that they attend relatively few classes, and other students come to class regularly yet earn relatively low grades. Although students' GPAs are strongly correlated with their attendance rates, correlation does not imply causation. Causality might go either way; high

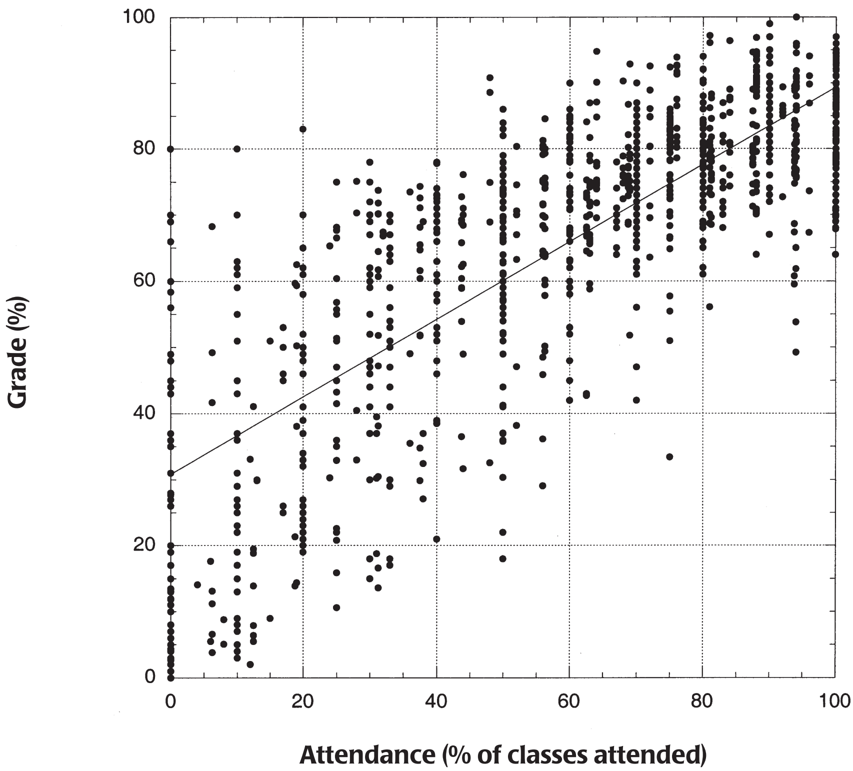

Figure 2. The association of attendance and grades in an introductory biology course taught in GC. The equation for these data is $y=30.9 + 0.58x$, and the correlation coefficient is 0.79.

rates of class attendance might help students earn better grades, or students' desires to make better grades might underlie their high rates of class attendance, or both. Nevertheless, the overall conclusion is unmistakable: the highest grades are usually earned by students who attend class regularly.

If class attendance is so important for academic success, why don't more developmental education students attend class? Students know that class attendance is important, and on the first day of classes they are confident that they will attend virtually all classes and earn an A or B in their courses (Moore, 2003a, 2003b). They also want and expect to receive academic credit for merely showing up at class (Launius, 1997; Moore, 2003a, 2003b). However, many instructors do not award academic credit for class attendance; these instructors agree with Davis (1993), who noted that "attendance should not be mandatory or a factor in your grading policy. Grades should be based on students' mastery of the course content and not on such nonacademic factors as attendance" (p. 138). However, this policy clashes with the fact that students' rates of class attendance are influenced by whether they receive academic credit for attending class; when they do not receive points for coming to class, they do not attend as many classes (Launius, 1997; Moore, 2003a, 2003b) and, as a result, do not meet their first-day-of-classes expectations about class attendance. These results are consistent with reports that developmental education students have a difficult time following through on their academic intentions (Pintrich & Garcia, 1994).

What about the lower grades that characterized students who had to be forced to attend the summer orientation? In GC's introductory biology course, these students attended 34% fewer classes and earned grades that were 33% lower than students who attended the orientation voluntarily (Moore & Jensen, in press). These differences were statistically significant ($p < 0.01$).

Students' involvement in other course-related activities. In light of the strong association of class attendance with high grades, I hypothesized that other motivation-based behaviors would also correlate positively with academic success. To test this, I measured how students' attendance at optional help sessions correlated with students' grades. Students received no points for attending any of these help sessions, and the sessions were conducted by teaching assistants who had no knowledge of upcoming exams (i.e., students did not get any "inside information" at the help sessions). Nevertheless, students who attended optional help sessions made significantly higher grades than did students who did not attend such sessions (Moore, in press-c). Similar results have been reported by Grisé and Kenney (2002), who noted that students who attended at least one session of Supplemental Instruction earned higher grades than students who did not. Students who attended help sessions also attended class more often than did students who missed help sessions (Moore, in press-c).

First-semester and first-year GPA. GC students' first-semester GPAs strongly predict their second-semester GPAs (r [831] = 0.59, $p < 0.01$) and their first-year GPAs (r [801] = 0.85, $p < 0.01$). Contrary to popular belief, there are relatively few students who "turn things around" after a bad start; most students in GC who earn GPAs less than 2.0 during their first semester also earn GPAs less than 2.0 during their second semester and are suspended from the university (Moore, in press-b). Similarly, most students who get off to a good start in college continue to do well in subsequent semesters. For example, only 9% of students who earn first-semester GPAs greater than 2.0 end their first year of college with GPAs less than 2.0 (Moore, in press-b).

Students who earn the highest first-year GPAs also have much higher probabilities of graduating from the university than do students who earn low first-year GPAs. For example, (a) 85% of the GC students who graduated from the university between 1995 and 2003 had first-year GPAs above 2.5, and (b) students having first-year GPAs less than 2.0 comprise only about 1% of the GC students who graduated from the university during the same period (*General College Graduate and Transfer Students*, 2003). To survive the "transfer shock" that occurs when developmental education students transfer to degree-granting colleges (Best & Gehring, 1993; Graham & Dallam, 1986; Graham & Hughes, 1994), most developmental education students need first-year GPAs above 3.0 if they are eventually to graduate from the University.

Academic Achievement Motivation

Because academic success results from a variety of factors, it is not surprising that GC's most successful students exhibit a variety of effective academic behaviors. For example, they are more likely to attend class, help sessions, and summer orientation sessions than are students who do not succeed in GC. These behaviors are a surrogate for, and a clear expression of, a student's academic achievement motivation, which is a student's motivation toward performance goals (e.g., high grades, praise, outperforming other students) or learning goals (e.g., improving oneself, learning for learning's sake; Cavallo, Rozman, Blickenstaff, & Walker, 2004). Although academic motivation can be expressed in many ways, one explicit expression of students' motivation is their class attendance and participation in other course-related activities. These behaviors require a consistent and ongoing effort that is related directly to a student's educational success.

Motivation is important because it affects students' willingness to approach academic tasks, invest the required time and energy, and maintain enough effort to complete academic tasks successfully (Ray, Garavalia, & Murdock, 2003). GC's most successful students invest in and excel at a variety of course-related activities that optimize their chance of academic success. For example, the students most likely to attend class regularly are also most likely to attend help sessions, study more, read the assigned chapters in the course textbook, and comply with course assignments (Moore, 2003a, 2003b). All of these behaviors are explicit expressions of students' academic motivation. Differences in academic motivation also help explain why many seemingly "smart" students do not do as well in college as "average" students. Motivation, which students express as persistence, hard work, and simply showing up, usually produces success; innate intelligence often does not. It is usually the most motivated students, and not necessarily those with the highest scores on standardized tests, who succeed in college. Developmental education students should heed Woody Allen's claim that "Eighty percent of success is showing up" (Moncur, 2004).

Although academic achievement motivation is especially important for the academic success of developmental education students (Allen, 1999; Prus, Hatcher, Hope, & Gabriel, 1995; Thomas & Higbee, 2000), there are alternate explanations for the data presented here. For example, students whose parents are unfamiliar with college may not be encouraged to attend summer orientation, classes, and help sessions. Alternately, students who do not come to class or other course-associated activities may be working and not have time to attend class. However, previous research indicated that students who support themselves financially while pursuing their education attend class more often and earn higher grades than students whose education is paid for by others (Devadoss & Foltz, 1996), and my interviews with students who seldom come to class indicate that their top non-illness reason for missing class is that they value socializing more than their academic coursework. These findings are consistent with the fact that students who drop out of GC cite a lack of motivation as the most frequent reason (e.g., far ahead of factors such as health and finances) for quitting school (Hatfield, 2003).

Discussion and Recommendations: Helping Students Succeed

My research is consistent with the following recommendations to help developmental education students succeed in college:

1. Emphasize the importance of motivation for academic achievement. Many high school students are poorly motivated and not involved with their education (Gehring, 2003). This lack of motivation clashes with the fact that academic motivation is the most important factor and accurate predictor of the academic success of developmental education students (Caballo, Rozman, Blickenstaff, & Walker, 2004; Ley & Young, 1998; Moore et al., 2003; Ray, Garavalia, & Murdock, 2003; VanZile-Tamsen & Livingston, 1999). Although traditional students usually have academic skills and experiences that enable them to cope with some absences from course-related activities, developmental education students often do not. This is why developmental education students wanting to succeed in college must be motivated enough to attend class regularly. The importance of class attendance was described this way by Thompson (2002): "If a student ever complains about a grade or how tough the course is, one of the first things I look at is class attendance. That usually says it all" (p. B5). Thomas and Higbee (2000) were more succinct when they concluded that "nothing replaces being present in class" (p. 229).

2. Emphasize the importance of class attendance throughout the semester. On the first day of classes, most instructors tell students that class attendance is important for academic success. However, such announcements seldom improve students' rates of class attendance (Moore, 2003a, 2003b).

Students are accustomed to hearing such proclamations and are not overly impressed. However, students' rates of class attendance and academic success do improve when students are shown quantitative data documenting the importance of attendance for academic success throughout the semester (Moore, 2003a). For example, in my classes I (a) include data such as those shown in Figure 2 in the course syllabus, (b) discuss these data on the first day of classes, (c) have students write and submit an essay interpreting Figure 2 on the first day of classes, and (d) show students Figure 2 every day in the minutes before class begins. This ongoing reinforcement of the importance of class attendance for academic success improves the attendance and grades of approximately 20% of students in the course (Moore, 2003a).

3. Use data to show students the importance of getting off to a good start in college. Developmental education students need to understand this harsh reality: If they earn low grades during their first semester, they will probably also earn low grades during their second semester and be dismissed from the university (Moore, in press-b). Although first-semester grades are not destiny, they do accurately predict students' academic success. Do not let students delude themselves into thinking that they merely had an "off" semester from which they will easily recover. They probably will not.

4. Emphasize the importance of hard work for academic success. Many developmental education students may not understand, or do not believe, that there is a causal relationship between academic preparation, effort, and performance, and may therefore believe that attending class, help sessions, and other course-related activities is not necessary for academic success. This belief may be well justified, for first-year students who entered college in the fall of 2002 nationwide spent "far less" time studying than any previous entering class of college students, yet had higher high school grades than any previous class (Marklein, 2003; Sax, Lindholm, Astin, Korn, & Mahoney, 2002; Young, 2002, p. A36). Indeed, (a) a record-high percentage (46%) of these students had an A average in high school despite the fact that a record-low percentage (33%) of these students studied less than 6 hours per week, and (b) in the past 15 years, the percentage of first-year students who study less than 1 hour per week has nearly doubled, from 8.5% to 15.9%. Although high school readies only about one in three 18-year-olds for college (Schouten, 2003), many first-year students believe that the same amount of effort that produced their high grades in high school will produce the same grades in college (Young, 2002). The worst study habits and lowest amount of effort on record have produced the highest grades on record, so we should not be surprised when students question or ignore advice about the amount of effort required for academic success in college. Even so, the fact remains: students who accept our claims that behaviors such as attending class are

beneficial and who follow through appropriately will incur a significant advantage. These students will probably learn more, make higher grades, out-compete their classmates, and have a greater chance of graduating from the university than poorly motivated students who ignore advice about the importance of course-related activities such as class attendance (Moore, in press-a, in press-b).

5. Tell students that they may not be ready for college. Although most students believe that graduation from high school ensures that they are well prepared for college, more than one-third of first-year college-students enroll in at least one remedial course, which is up from 28% in 1995 (Cavanagh, 2003a, 2003b). Even the best students are often underprepared for college; this is why 30% to 40% of students in many states who have earned academic scholarships for their high school grades have to take remedial courses when they start college (Schouten, 2003). Clearly, the tests used to measure high school students' academic skills are poor indicators of college readiness (Cavanagh, 2003a; Hebel, 2003), and graduation from high school is not synonymous with being prepared for college.

6. Emphasize that students are responsible for their education. Few circumstances will stop a motivated student who is determined to succeed academically. However, many developmental education students have behaviors that are inconsistent with academic success; for example, they often skip class, turn in assignments late, value socializing over studying, ignore valuable advice, and expend only enough energy to "just get by" (Grisé & Kenney, 2003; Yaworski, Weber, & Ibrahim, 2000). Although instructors should offer up-to-date, rigorous, and inclusive courses, a student's education is ultimately the student's responsibility. If students are to succeed academically, they must engage themselves in their education and be motivated to learn. This is especially true for developmental education students, who often lack some of the academic experiences and skills possessed by other students. If students are not motivated enough to engage themselves in their education, there is little that instructors, advisors, and others can do to help. Although we should continue to try to devise programs to help these students, we should not expect these programs to be overly successful. After all, the success of any such program depends on students' participation, and it is students' lack of participation in their education that correlates so strongly with their increased probabilities of academic failure.

7. Emphasize to students that they can succeed. Many developmental education students have become accustomed to below-average grades and test scores and often wonder whether they can succeed in college. Show students that motivated students, even those having relatively low high school graduation percentiles and low scores on standardized tests, can overcome many

obstacles with a strong work ethic that engages them with, and thereby enables them to take control of, their education. Scores on standardized tests, and the resulting "at risk" labels that often accompany students having such scores, are not destiny.

Developmental education programs continue to play critical roles in helping thousands of underprepared students become college graduates. Although these programs offer students many valuable resources, they cannot be overly effective if students do not understand what they must do to succeed. Students will be more successful if we provide explicit, research-based recommendations about what behaviors they will need to excel.

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