Chapter Three

Students

Issue 8: Student Retention

Key Indicator 8.0: Student intention to continue in the study of mathematics

Sub Indicators
8.1 Students feel that the instructor is aware of the mathematical needs of their major field of study
8.2 Students believe that the content of the course they have just completed will be useful in their future
8.3 Students look forward to taking more mathematics
8.4 Proportionate numbers of women intend to continue in the study of mathematics

Issue 9: The mathematics department as a community of learners

Key Indicator 9.0: Student participation in the life of the department

Sub Indicators
9.1 Students take part in supplementary (non-class) mathematical support services
9.2 Students take part in supplementary (non-class) mathematical activities (e.g., lectures, colloquia, math clubs, etc.)
9.3 Students feel that technology (calculators and/or computers) is helpful in learning mathematics
9.4 Students take part in social activities of the department

Issue 10: Diversity

Key Indicator 10.0: Proportional representation by gender and race/ethnicity of students in mathematics courses

Sub Indicators
10.1 (Lower division) student enrollment in the department shows gender diversity
10.2 (Lower division) student enrollment in the department shows racial/ethnic diversity
Chapter Three

Students

(The Principal Investigators reported that). The use of student-centered and active learning instructional modes (e.g. cooperative learning) were most effective in stimulating students and improving their learning. Students interviewed .... confirmed that most of them enjoyed the student-centered learning environment and believed that they learned better. Eiseman, Jeffrey W., et al. (1998) Evaluation of the Division of Undergraduate Education’s Course and Curriculum Development Program. Arlington, VA: National Science Foundation NSF 98-39 (pages xi-xiii ).

3.0 The mathematical sciences ‘pipeline’

The mathematical sciences ‘pipeline’-- the proportion of students who continue to enroll in mathematics or mathematics-based courses throughout their program—is a major issue of concern to departments. A depiction of the pipeline was given in Chapter Zero (page 0-8) and is repeated here for convenience (Figure 3.01). An earlier version of this figure appeared in the National Academy of Sciences report, ‘Everybody Counts’, which is an eloquent plea for significant and far-reaching reform in mathematics education, kindergarten through college (Washington, DC: National Academy Press, 1989). In that report, it is noted that:

More than any other subject, mathematics filters students out of programs leading to scientific and professional careers. From high school through graduate school, the half-life of students in the mathematics pipeline is about one year; on average, we lose half the students from mathematics each year...Mathematics should be a pump, not a filter. (National Research Council, Everybody Counts (p. 7), emphasis added)
Figure 3.0.1: Retentivity in the mathematical sciences ‘pipeline’


The limitations of the ‘pipeline metaphor’ are elaborated upon by Hurtado and Dey in Volume III, Chapter Five, of the present report. However, for the purposes of this chapter, suffice it to note that their main objection has to do with focusing on the ‘traditional’ college student in mathematics and mathematics-based fields of study. As Hurtado and Dey state:

..these trends (changing contexts of undergraduate education) suggests that we have an increasingly fluid population of students who may participate in the study of undergraduate mathematics at different life stages, at different stages in their undergraduate education, with different attitudes, interests and motivations; and with very different preparation and proficiency levels. (Hurtado and Dey, 1994, p 6)

That is to say, they find the canonical ‘pipeline’ model too limiting and restrictive in addressing the needs of those students with diverse backgrounds (ethnic, race, non-mathematics specialist, etc) who are seeking competence in the mathematical sciences in order to enable them to prepare for functional participation in future aspects of study and work.

Hurtado and Dey propose, alternatively, a model that is more like that of a public transportation system in a metropolitan area. In public transportation, there is great flexibility as to when and where persons can access and leave the system. Such a model, they suggest, requires the development of ‘new frameworks which build upon yet extend the traditional pipeline metaphor for understanding student participation in undergraduate mathematics’ (p.6) In the current chapter, we look at issues of student retention, in the light of data that were gathered on the extent to which students participate in the life of the mathematics department, as well as on the diversity of the student body (corresponding demographic data on the instructional staff are provided in Chapter One).
3.1 Student retention

Key Indicator 8.0 Student intention to continue in the study of mathematics

A perennial concern for college mathematics instruction is the high failure and drop out rates for many courses. The issues are varied. What are the failure and withdrawal rates for key lower division mathematics courses? Do they affect certain kinds of students more than others (e.g., minorities, those returning to school, part-time students, etc.)? Are there specific provisions in place designed to increase retention and success? How do students perceive mathematics courses -- as filters and gateways or as something more positive? Do students perceive departments and instructors as concerned, active in helping them succeed, and/or effective in doing so?

Indicator 8.1 Students feel that the instructor is aware of mathematical needs of their major field of study

Figure 3.1.1 [8.1] The instructor was aware of the mathematical needs of my major field of study.

The extent to which students believe that their instructors are ‘in synch’ with the mathematical needs of the ‘client disciplines’ is surely an important component of a learner’s comfort level with a mathematics course. Figure 3.1.1 displays data concerning students’ perceptions of their instructors’ awareness of the mathematical needs of the students major field of study. The overall pattern of responses is somewhat similar for each of the sites.

At the other end of the agreement spectrum (refer again to Figure 3.1.1) it is noted that substantial proportions of students at all 3 sites were in DISAGREEMENT with the statement all their instructors were aware of the mathematical needs of their field of study.
Figure 3.1.2[8.1] Percent of students reporting in agreement that instructor was aware of the mathematical needs of their major field of study.

As Figure 3.1.2 makes clear, CC is noteworthy in that a majority of students endorse the proposition that their instructor was indeed aware of such needs. At CU, 40% of the students and at RU only about one-fourth of them agree or strongly agree with the statement.

**Indicator 8.2 Students believe that the content of the course they have just completed will be useful in their future**

Figure 3.1.3[8.2] Students believe content of course will be useful.

Arguably, closely related to student perception of instructor awareness of the mathematics needs of the client disciplines are student attitudes about the utility of the content of the course in which they are enrolled. In Figure 3.1.3, there is again a somewhat similar pattern in the general trend of the data among the three sites. There is the tendency for students at all campuses to agree that the content of the mathematics course in which they are enrolled will be useful. At the other end of the spectrum, a relatively
small proportion of students at each site (12% to 14%) are in DISAGREEMENT with the belief that the content of the mathematics course will be useful. These data suggest, overall, a rather positive view of the students concerning the applicability of the mathematics courses they are taking at their respective campuses.

Figure 3.1.4[8.2] Proportion of students in agreement that the content of their course will be useful.

As Figure 3.1.4 suggests, it is the CC students, again, that are substantially more in agreement than are those at the other two sites (71% of the CC students compared with approximately 60% at each of the other sites) concerning the utility of their mathematics courses.

Indicator 8.3 Students look forward to taking more mathematics.

Figure 3.1.5[8.3] Students look forward to taking more mathematics.
Many factors contribute to a student’s decision as to whether s/he has a positive attitude toward taking more mathematics courses. Those factors referenced in Indicators 8.1 (Instructor awareness of mathematics needs of student’s field of study) and 8.2 (Perceived utility of the course) are surely an important component of these factors.

Figure 3.1.5 reveals that the patterns of student responses to ‘Looking forward to taking more mathematics’ differ notably from those for Indicators 8.1 and 8.2. In particular, only 21% the CU students endorse the statement while nearly 50% of them do not endorse it. At CC, on the other hand, nearly 50% endorse the statement (do look forward to taking more mathematics) and nearly 30% do not. At RU the students are nearly evenly divided in their opinion, with 36% agreeing that they look forward to taking more mathematics and 33% disagreeing with that sentiment.

Figure 3.1.6[8.3] Percentage of students looking forward to taking more mathematics.

As Figure 3.1.6 documents, again, the CC students appear to ‘take the prize’ in terms of proportions looking forward to more mathematics. Nearly one-half (48%) of the CC students do so. At RU, slightly more than one-third (36%) and at CU, slightly less than one-fourth (21%) are so disposed.

**Indicator 8.4 Proportionate numbers of women and ethnic minorities intend to continue in the study of mathematics**

The issue of retention relates to the recruitment of majors in the areas of science, mathematics, engineering, and technology education. This also includes education-related majors in these specialty areas. Another issue related to retention is that of remediation (support services). It is a fact of life in higher education that a certain percentage of the entering students lack the mathematical competencies necessary to pursue college level work. Indeed at some colleges, especially two-year schools, providing remediation for such students is an integral part of their institutional mission.
The goal of the following data exploration is to see whether there is evidence of differential retention in the study of mathematics, by gender: for example, are males more likely than females to continue to take mathematics courses? Table 3.1.1 below provides the numbers upon which Figures 3.1.7 to 3.1.9 are based.

**Table 3.1.1** Proportion of students intending to take another mathematics course, by course type and gender.

<table>
<thead>
<tr>
<th></th>
<th>CU, N =341</th>
<th></th>
<th>CC, N = 210</th>
<th></th>
<th>RU, N =1366</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Female=yes</td>
<td>Male</td>
<td>Male=yes</td>
<td>Female</td>
</tr>
<tr>
<td>Pre-calculus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>163</td>
<td>85</td>
<td>68</td>
<td>43</td>
<td>36</td>
</tr>
<tr>
<td>Percentage</td>
<td>71</td>
<td>52</td>
<td>29</td>
<td>63</td>
<td>41</td>
</tr>
<tr>
<td>Calculus</td>
<td>N</td>
<td>58</td>
<td>31</td>
<td>52</td>
<td>30</td>
</tr>
<tr>
<td>Percentage</td>
<td>53</td>
<td>53</td>
<td>47</td>
<td>58</td>
<td>31</td>
</tr>
</tbody>
</table>

Note: In Table 3.1.1:
First percentage is for total students enrolled. For example, 71% of the pre-calculus students at CU are female. Second percentage is of the gender being considered. For example, 52% of the 163 females in pre-calculus at CU reported intention to take another mathematics course.
At CU, in the pre-calculus course, the projected retention of females (52%) is slightly less than for males (63%). It is noted that the larger proportion of females in the pre-calculus courses might be due to the elementary pre-service program. Or it could be that general education requirements (for, say, Liberal Arts), specifying a sequence of mathematics courses, apply more to the females (males might tend to be enrolled more in science and engineering courses (requiring calculus). For the calculus courses, relatively equal proportions of females and males enrolled, and proportions intending to take more mathematics are comparable.
Figure 3.1.8[8.4] CC students intending to take another mathematics course, by type of course currently enrolled: pre-calculus or calculus

At CC, the estimated retention rates for both pre-calculus and calculus courses are remarkably high for both females and males, with females being slightly favored (94% intention for females in pre-calculus and 87% for females in calculus). It would be interesting and important to carry out a detailed study to help account for these commendable retention rates.
At RU, only calculus courses were surveyed. The estimated retention rate for females is somewhat lower than for males, but nearly 3 out of 4 females do report their intention to remain in mathematics.

3.2 Student Participation in departmental (non-class) activities

Persons studying mathematics may feel disconnected from whatever else goes on in the department, other than the specific course(s) that they take, in which they may often feel like they are just one more anonymous “warm body.” Researchers on college student settings and behaviors have over the past twenty years consistently identified a particular set of ‘student-oriented’ attributes of the institutional environment that appear to be associated with high involvement and achievement (Astin 1993, Pace 1990, Pascarella and Terenzini 1991).

The following indicators are designed to capture important aspects of the level of student involvement in the life of the department.

**Issue 9: The mathematics department as a community of learners**

**Key Indicator 9.0 Student participation in the life of the department**

> It is recommended that…..Science, mathematics, engineering and technology departments…Create and support learning communities for students and faculty, including clubs, social events and peer learning and group study opportunities. (George, M. *et al.* *Shaping the future*, 1996, page 65)

A common theme in the research literature bearing on the development of effective instructional programs deals with the importance of developing an environment in a mathematics department that is supportive and nurturing for students (see, for example, Ewell, 2001, Astin, 1993 and George, 1996).

The following indicators identify specific aspect of the life of the department that can potentially be supportive to learners.
Indicator 9.1 Students take part in supplementary (non-class) mathematical support services

The support services targeted in this indicator have to do with help from the instructor, participation in study groups, tutorial services provided by teaching assistants and the services of a mathematics laboratory. Following are student data referring to participation at the CC and RU sites.

Figure 3.2.1[9.1] CC student participation in supplementary mathematical support services

<table>
<thead>
<tr>
<th></th>
<th>Help from Instructor</th>
<th>Study groups</th>
<th>Tutoring by TA</th>
<th>Math lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not available</td>
<td>3</td>
<td>57</td>
<td>28</td>
<td>10</td>
</tr>
<tr>
<td>Available/Not used</td>
<td>36</td>
<td>37</td>
<td>49</td>
<td>57</td>
</tr>
<tr>
<td>Seldom</td>
<td>42</td>
<td>3</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Often</td>
<td>19</td>
<td>3</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

Seldom: about once a month  
Often: more than once a month

1 Certain items relating to student participation were not administered by CU.
Figure 3.2.2[9.1] RU student participation in support services

The data suggest that at both sites (CC and RU) relatively few of the students take advantage of the various support services that are available. The data raise questions as to whether students are sufficiently informed about the support that is available.
Academic preparation
In spite of their apparent academic success in high school, students also report that they are in need of additional academic support services. Hurtado and Dey note that this is especially interesting, since more than 93% of all students entering college in 1993 had at least three years of high school mathematics (up from 85 percent in 1984), while three out of ten students (in 1993) expected to need special tutoring or remediation in mathematics (up from 22 percent in 1982). (Hurtado and Dey, Volume III, Chapter 4, p. 5)

Indicator 9.2 Students take part in supplementary (non-class) mathematical activities (e.g. lectures, colloquia, math clubs, etc.)

As is displayed in Figures 3.2.3 and 3.2.4 below, student participation in supplementary mathematics activities at CC and RU is low. Data from CU were not available.

Figure 3.2.3 [9.2] CC students take part in supplementary mathematical activities

<table>
<thead>
<tr>
<th></th>
<th>Not available</th>
<th>Available/Not used</th>
<th>Seldom</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honors sections of course</td>
<td>48</td>
<td>50</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Advising by a member of the math faculty</td>
<td>17</td>
<td>44</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Mentoring by a member of the math faculty</td>
<td>24</td>
<td>55</td>
<td>14</td>
<td>6</td>
</tr>
</tbody>
</table>
Figure 3.2.4 RU students take part in supplementary mathematical activities

<table>
<thead>
<tr>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Not available</td>
</tr>
<tr>
<td>Honors sections of course</td>
</tr>
<tr>
<td>Advising by a member of the math faculty</td>
</tr>
<tr>
<td>Mentoring by a member of the math faculty</td>
</tr>
</tbody>
</table>

Indicator 9.3 Students feel that technology (calculators and/or computers) is helpful in learning mathematics

Various national reports (see, for example, George Report to NSF, page 65) recommend the use of various technologies for instruction. The following data suggest that students at the three campuses have confidence in the use of calculators and/or computers in doing mathematics (See Figure 3.3.1), and find these technologies helpful as they do mathematics (See Figure 3.3.2). Furthermore (see Figure 3.3.3) the students regard calculators and/or computer as helping them find answers more quickly and accurately. It is important to note, however, that we do not have data here on HOW the technologies are used.

Figure 3.3.1[9.3] Students feel confident in using calculators and/or computers to do mathematics.

SD: Strongly Disagree; D: Disagree; U: Undecided; A: Agree; SA: Strongly Agree (Note: For CU, data are missing.)
Figure 3.3.2[9.3] Students believe that using a calculator or computer is helpful.

SD: Strongly Disagree; D: Disagree; U: Undecided; A: Agree; SA: Strongly Agree

Figure 3.3.3[9.3] Using calculators and/or computers helps me answer questions more quickly and accurately.

SD: Strongly Disagree; D: Disagree; U: Undecided; A: Agree; SA: Strongly Agree (Note: For CU, data are missing.)
Indicator 9.4 Students take part in social activities of the department

‘A sense of community is an essential element in providing students a strong undergraduate education...Whereas graduate students may readily gravitate to disciplinary colleagues around common research interests, beginning undergraduates rarely arrive with common intellectual connections.’ (Boyer Report, Page 34)

Figure 3.4.1[9.4] Students make use of mathematics department lounge or gathering place

Note: CU data are not available. Seldom: about once a month Often: more than once a month

The data in Figure 3.4.1 suggest that students at CC and RU make little use of ‘social or gathering places’. This finding bears more scrutiny. It is possible, for example, that many undergraduates are unaware of the availability of such places in the department.
3.3 Diversity of the student body

**Issue 10 Diversity**

**Key Indicator 10.0 Proportional representation by gender and race/ethnicity of students in mathematics courses**

College mathematics has long been portrayed as being the preserve of white middle and upper class males. Various mandates and programs have been suggested to try to remedy this situation (reference, for example, the NSF initiatives for minority participation in the mathematical sciences in their Human Resources Development Programs.) The indicators below are designed to address the extent to which there is diverse student participation in a department’s programs.

**The changing context of undergraduate education**

There have been sharp increases in the number of older students, women and racial/ethnic minorities represented at the undergraduate level (Carter and Wilson, 1992; Dey and Hurtado, 1994)

There has been a reversal of a historical pattern of gender underrepresentation within higher education in general, so that women now represent the majority of students in higher education in general, as well as constitute the majority of those entering as first time, full-time freshmen (Solomon, 1985; Dey and Hurtado, 1994).

Adults over the age of 25 have been the fastest growing group, currently representing over 40 percent of all students in higher education (US Dept of Educ, 1992).

**NSF Programs to promote diversity in science, engineering and mathematics**

The programs of the Division of Human Resource Development reflect the Foundation's commitment to developing the resources of the scientific and technical community as a whole. This division has primary responsibility for broadening participation of underrepresented groups in science, engineering and mathematics (SEM). See: [http://www.ehr.nsf.gov/EHR/HRD](http://www.ehr.nsf.gov/EHR/HRD)

The approach includes:
- a coordinated set of efforts to prepare, attract, and retain increased numbers of minority students in science, engineering, and mathematics at the undergraduate and graduate levels;
- activities for women and girls that can produce immediate and long-term positive changes in the infrastructure of SEM research and education;
- efforts to facilitate greater involvement of students and faculty with disabilities in science and engineering and in NSF-supported activities; and
- activities to strengthen research and training capabilities of academic institutions with significant minority student enrollments
Indicator 10.1 (Lower division) student enrollment in the department shows gender diversity

Figure 3.5.1[10.1] Female enrollment: Entire campus and (lower division) mathematics

CU is noteworthy in that the proportion of females taking mathematics is nearly identical to the proportion of (lower division) females on the entire campus (that is, 67% of the students on campus are female, while 65% of the students in the surveyed mathematics courses are female). At the other two sites a substantially lower percentage of females are in the surveyed mathematics courses than are on each campus.

Figure 3.5.2[10.1] RU Percentage of females enrolled in selected programs

Figure 3.5.2 reveals that at RU, substantially smaller proportions of females are majors in mathematics/computer science, or in engineering than is found on the campus. Corresponding data were not available for the other two campuses.
The following graphs present some of the data already reported in Section 3.2, but provide a comparison group at the campus level. For example, at CU, 67% of the students are female. And as Figure 3.5.3 shows, substantially more females, proportionally (75%), are enrolled in the pre-calculus courses. On the other hand, substantially fewer (50%) females than the campus rate of 67% are in calculus courses. The predominance of females in the pre-calculus courses is, perhaps, attributable to the CU mathematics for elementary teachers program.

Figure 3.5.3[10.1] Female student enrollment, campus level and in mathematics courses, pre-calculus vs calculus at CU and CC.

At CC, the female enrollment in pre-calculus courses is only slightly less than the campus proportion of females. However, female representation in the calculus courses is nearly 20 points less than the campus (29% for calculus compared with 57% females on campus).
Figure 3.5.4 [10.1] Female enrollment, campus vs. calculus, for RU

At RU, while nearly 50% of the students on campus are female, only slightly more than 1/3 of the calculus students are female. This disparity in female representation in calculus is, unfortunately, reflective of national data (see, for example NSF report, *Shaping the Future*, below).
Ethnicity

All NSF’s grant-making units should…Continue their support of strong activities to correct under-representation of women, minorities and persons with disabilities among students and faculty at the undergraduate level. *(Shaping the future, NSF, 1996, page 71)*

**Indicator 10.2 (Lower division) student enrollment in the department shows racial/ethnic diversity**

Tables 3.6.1 and 3.6.2 and corresponding Figures 3.6.1 through 3.6.3 display data on student enrollment in lower division mathematics at the three campuses, compared with campus level ethnicity enrollment data. There are some similarities in the enrollment patterns, but also some noteworthy exceptions. At CU, representation in mathematics courses by Asian/Hawaiian or other Pacific Islander at 10.4% and by American Indian or Alaska Native at 3.2% is slightly above the campus level of enrollment at the rates of 9.5% and 1.1%, respectively. African American representation is about at the campus level while Hispanics, at 12.6% in the mathematics courses are somewhat below the campus rate of 22.7%. Rates for whites and for Other are at about the campus rate. The lower representation by Hispanics in the mathematics courses would seem to merit further investigation.

**Table 3.6.1[10.2]  CU Race/Ethnicity enrollment data (campus data are for lower division students)**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>% Campus enrollment</th>
<th>% Mathematics enrollment (N=436)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian /Native Hawaiian or other Pacific Islander</td>
<td>9.5</td>
<td>10.4</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>1.1</td>
<td>3.2</td>
</tr>
<tr>
<td>African American</td>
<td>3.5</td>
<td>3.9</td>
</tr>
<tr>
<td>Hispanic</td>
<td>22.7</td>
<td>12.6</td>
</tr>
<tr>
<td>White</td>
<td>50</td>
<td>52.9</td>
</tr>
<tr>
<td>Other</td>
<td>13.3</td>
<td>16.9</td>
</tr>
</tbody>
</table>

**Figure 3.6.1 [10.2] CU student mathematics vs campus enrollments, by ethnicity**
At the community college (CC) (see Figure 3.6.2 below), Asian enrollment at nearly 12% and Hispanic at 30% are well beyond the campus proportions of 4% and 2% respectively. It is possible that the proximity of the college to a major university affects these proportionately high enrollment rates (for example, CC serving as a transition campus to a university).

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>% Campus enrollment</th>
<th>% Mathematics enrollment (N=514)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian /Native Hawaiian or other Pacific Islander</td>
<td>4</td>
<td>11.9</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>African American</td>
<td>13</td>
<td>7.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td>30.1</td>
</tr>
<tr>
<td>White</td>
<td>76</td>
<td>45.4</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Table 3.6.2[10.2]  CC Race/ethnicity mathematics vs campus enrollments

Figure 3.6.2 [10.2] CC Race/ethnicity mathematics vs campus enrollments
At the research university (RU), enrollment data are again in accordance with national trends, with a somewhat over-represented Asian/Hawaiian presence (17.7% for mathematics vs 13% for the campus). For other groups, there is under-representation by African Americans (3.1% for mathematics vs 9% for the campus) and for Hispanics (3.4% for mathematics vs. 6% for campus).

Table 3.6.3[10.2] RU Race/ethnicity mathematics vs campus enrollments (campus data are for lower division students)

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>% Campus enrollment</th>
<th>% Mathematics enrollment (N=436)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian /Native Hawaiian or other Pacific Islander</td>
<td>13</td>
<td>17.7</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>African American</td>
<td>9</td>
<td>3.1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6</td>
<td>3.4</td>
</tr>
<tr>
<td>White</td>
<td>69</td>
<td>71.7</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Summary Comments

The data in this chapter have largely to do with student attitudes, participation rates in courses and support services and with issues of diversity.

**Attitudes toward mathematics as a subject of study**

Students are generally positive toward the study of mathematics. They feel that the instructor is aware of the mathematics needs of their major field of study and believe the content of the course they are taking will be useful. They are less positive about looking forward to taking more mathematics. However, on all three indicators, the community college students are generally more positive, with less differential in these attitudes noted between the state university and the research university.

**Differential intention of females and males to remain in the study of mathematics**

A slight difference in retention in mathematics in favor of the males was found, with a more pronounced difference at RU. However, CC is noteworthy in the relatively high inferred retention rate (close to 90%) of both males and females in both pre-calculus and calculus courses, with females slightly favored in the pre-calculus courses.

**Students taking part in (non-class) mathematical support services**

Data were available for only CC and RU. Generally, the students report not taking part in such support services as study groups, tutoring or mathematics laboratories, raising questions as to whether students are aware of such services.

**Student attitudes toward the role of calculators and/or computers in mathematics class**

Students at all three sites are generally positive in their attitudes toward calculator and/or computers in mathematics class. They feel confident in the use of these technologies and believe that calculators and computers help them answer questions more quickly and accurately.

**Gender diversity in mathematics**

Generally, the national patterns found for under-representation of women in mathematics are borne out by the data from the three sites. The proportion of females enrolled in lower division mathematics courses is less than the proportion of females on campus. A noteworthy exception is the pre-calculus sequence at the comprehensive university, where nearly 10% more women are enrolled than the campus proportion. This is believed to reflect the predominance of females in the mathematics for elementary teachers sequence.

**Racial/ethnic diversity**

Again, national patterns are reflected here. Proportionately, more Asians/Hawaiian Islanders are in mathematics than are on each campus, as a whole. Fewer African-Americans are in mathematics than are present on campus, proportionately. Various initiatives such as the NSF programs in Human Resource Development are designed to help increase participation in mathematics by under-represented minorities.