Working with Community Colleges

Engineering Dean’s Institute
ASEE

April 17, 2012

Eun-Woo Chang
Dean of Science, Engineering and Mathematics
The role of community colleges in the education of scientists and engineers

- Community Colleges are important institutions in the education of science and engineering graduates
  - Almost 50 percent of science and engineering bachelor’s and master’s graduates have attended community colleges
  - 12 percent of nation’s science and engineering doctoral degree recipients have attended community colleges (varies significantly by race/ethnicity)

Source: National Science Foundation, Division of Science Resources Statistics (2004-2006)
The role of community colleges in the education of scientists and engineers

- Hispanics and American Indians/Alaska Natives have attended community colleges in higher numbers than have Whites, Blacks, or Asians/Pacific Islanders

- Female graduates in S&E fields are far more likely than male counterparts to have attended community Colleges

- **Open admissions, proximity to jobs and family, and low tuitions and fees make community colleges attractive to a large number of S&E students**

Source: National Science Foundation, Division of Science Resources Statistics (2004-2006)
Montgomery College

- Founded in 1946
- The largest undergraduate institution in Maryland serving more than 60,000 students
- More than 160 countries are represented and no majority race in the student population
- Three campuses; **Rockville**, Germantown, Takoma Park/Silver Spring
- New STEM related construction project
  - **Science Center building (RV)** – completed in 2011
  - Bioscience Education Center (GTN) – in progress
  - Science and Math Center (TP/SS) – future plan
Montgomery College
Science, Engineering and Mathematics

MC Engineering Program

• The largest University transfer program in the country
• Designed to provide the first two years of a four-year program leading to a B.S. in engineering
• Concentrations include aerospace, bioengineering, chemical, civil, computer, electrical, fire protection, materials science, mechanical, and nuclear engineering.
• Fall 2011 enrollment is about 1,250 students
  52.2% are Montgomery County Public Schools graduates
• Average age is 23 years
• 13 FT faculty, 22 Adjunct faculty, and 5 FT/PT staff
  11 out of 13 FT faculty hold Ph.D.
  5 Asian, 2 African American, 6 Whites, and 6 female
Enrollments (Fall 2011)

- Full-time Students: 703
- Part-time Students: 589
- All Others: 16,771

Engineers

- Full-time: 8,939
- Part-time: 16,771
Gender (Fall 2011)

<table>
<thead>
<tr>
<th></th>
<th>Full-time</th>
<th>Part-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Engineers</td>
<td>597</td>
<td>515</td>
</tr>
<tr>
<td>Female</td>
<td>106</td>
<td>74</td>
</tr>
<tr>
<td>Male All Others</td>
<td>4,299</td>
<td>4,640</td>
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<tr>
<td>Female All Others</td>
<td>7,252</td>
<td>9,519</td>
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Engineering Majors at MC

<table>
<thead>
<tr>
<th>Year</th>
<th>Unduplicated Students</th>
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<tbody>
<tr>
<td>FY2007</td>
<td>1,134</td>
</tr>
<tr>
<td>FY2008</td>
<td>1,206</td>
</tr>
<tr>
<td>FY2009</td>
<td>1,359</td>
</tr>
<tr>
<td>FY2010</td>
<td>1,466</td>
</tr>
<tr>
<td>FY2011</td>
<td>1,653</td>
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</tbody>
</table>
Average Age
(Fall 2011 Enrollments)

<table>
<thead>
<tr>
<th></th>
<th>Full-time Students (9,642)</th>
<th>Part-time Students (17,360)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers</td>
<td>21.34</td>
<td>28.08</td>
</tr>
<tr>
<td>All Others</td>
<td>21.87</td>
<td>24.19</td>
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</tbody>
</table>

Montgomery College
Science, Engineering and Mathematics
Race (Fall 2011)

- **Asian:**
  - Full-time Engineers: 1614
  - Part-time Engineers: 17
  - Full-time All Others: 1065
  - Part-time All Others: 17

- **Black:**
  - Full-time Engineers: 2656
  - Part-time Engineers: 2077
  - Full-time All Others: 993
  - Part-time All Others: 3

- **Hispanic:**
  - Full-time Engineers: 94
  - Part-time Engineers: 75
  - Full-time All Others: 192
  - Part-time All Others: 1

- **Multi-Race:**
  - Full-time Engineers: 3
  - Part-time Engineers: 1
  - Full-time All Others: 133
  - Part-time All Others: 3

- **Native American:**
  - Full-time Engineers: 91
  - Part-time Engineers: 97
  - Full-time All Others: 2586
  - Part-time All Others: 8

- **White:**
  - Full-time Engineers: 48
  - Part-time Engineers: 3
  - Full-time All Others: 2337
  - Part-time All Others: 61

- **All Others:**
  - Full-time: 4959
  - Part-time: 5747
MC Engineering Transfers to 4-Year Institutions (2008 - 2011)

- UNIVERSITY OF MARYLAND, BALTIMORE COUNTY: 35, 39, 43, 32
- GEORGE WASHINGTON UNIVERSITY: 11, 7, 2, 0
- GEORGIA INSTITUTE OF TECHNOLOGY: 7, 3, 4, 11
- RENSSELAER POLYTECHNIC INSTITUTE: 2, 0, 1, 1
- OTHERS: 92, 84, 111, 158
MC Engineering Student Composition

- **Spring 2012 engineering enrollment = 1,226**
  - U.S. Citizens: 704
  - Permanent Residents: 308
  - International Students (F-1 Visa): 73
  - Other Foreign Students: 141

- **Declared Engineering Majors**
  - Total (1250), New in fall 2011 (364)
    - Mechanical (288), Computer (227), Electrical (218), Civil (160), General (106), Aerospace (98), Chemical (64), and Bioengineering (54), etc...
Keys for Success (Best Practice Models)

- Academic Advising and Mentoring
- Student Activities
- Resources
- Faculty qualifications and professional development opportunities
- Articulation agreement
- Academic preparedness of students
1. Academic advising and mentoring

- A dedicated engineering faculty advisor

- Currently developing on-line advising system

- SEM Internship Coordinator (FT): Writing workshops, internship opportunity info, and partnerships with Montgomery County Public Schools, industrial partners, federal agencies, and universities

- Most faculty serve as Engineering student club advisors
2. Student Activities

- Student clubs:
  Engineering Club, Women in Engineering, Science, and Technology (WEST) Club, Robotics Club, IEEE MC Student Branch, Engineers Without Borders (EWB)

- Engineering Seminars for Students

- Research Poster Session in spring

- Internships at NIST and several industrial partners sites (Patton Electronics, Innovative Biosensors, ATK Space Systems, etc...)
3. Resources

- New Science Building facilities (4th floor):
  6 physics/engineering/geoscience labs, 3 engineering computer labs, machine shop, and lab prep area

- Equipment/Instruments include:
  CNC Milling Machine, CNC Lathe, Robotic Arm, Seismometer capable of detecting earthquakes anywhere in the world magnitude 3 and higher, Advanced Function Generators and Oscilloscopes, two 3-D Printer, Electric Hydraulic Press capable of delivering 30,000 psi of pressure
- External Grants
  Fund for the Improvement of Postsecondary Education (FIPSE) – six sets of Mobile Classrooms and Dimension 3-D Printer
  NSF S-STEM
  NSF STEP (Being negotiated, $1.8M for five years)
  NSF Noyce Teacher Scholarship Program (submitted)

- Individual donors arranged by the MC Institutional Advancement Office
4. Faculty qualifications and professional development opportunities

- 11 out of 13 faculty hold Ph. D.s from U Penn, Ohio State, U of Illinois, etc...
- Professional development workshops for faculty and staff: e.g. SEM special lecture/workshop series including:
  “Peer-Led Team Learning”, Pratibha Varma-Nelson, IUPUI
  “Engineering Innovations in Engineering Education” Don Millard, NSF
  “Community College Undergraduate Research Initiative”, Jim Hewlett, Finger Lakes Community College, NSF-TUES
5. Articulation agreement

- Agreements in place with UMCP, UMBC, GWU, RPI, Georgia Tech, Capital College, and others.


**Challenges:**
- Working with multiple 4-year institutions (Engineering curricula are constantly changed/updated)
- Faculty workload (15-20 contact hours per week)
6. Academic preparedness of students

- Math and Science Learning Center
- Small class sizes: 18-20 in “Introduction to Engineering Design”, “Statics/Mechanics I”, and “Introduction to Programming Concepts for Engineers” classes
- Encourage faculty to adopt and adapt active teaching/learning pedagogies (SCALE-UP, PLTL, etc...)

- Two-thirds of incoming MC students are placed in developmental math or English
- Developmental students require more academic advising
- Recently initiated developmental math redesign project
Recommendation:

Transition from 2-yr colleges to 4-yr colleges of engineering:

- Increase presence at CC transfer day events
- Participates in Engineering club meetings
- Communicate with community college advisors
• Key Points for Success are.....

- Focus on Student Learning Gains
- Dedicated Faculty and Staff
- Innovation

and

- Administrator’s buy-in!!!
Working with Community Colleges

Thanks!

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