Education Overview

Stephen McKnight
Education Thrust Leader

NSF
Year Six Site Visit
April 4-6, 2006
CenSSIS Education Team

- S McKnight, NU
  - Education Thrust Leader

- K Hicks, NU
  - Partnership and Education Services Coordinator

- M Ruane, BU
  - Education Thrust Co-Leader

- R Rodriguez-Solis and S Cruz-Pol, UPRM
  - Education Thrust Co-leaders

- B Yazici, RPI
  - Education Thrust Co-leader

- C Duggan, NU
  - CESAME K-12 Outreach

- Paula Leventman
  - CenSSIS Evaluator and Diversity Coordinator
National Academies study:

“Rising Above the Gathering Storm”
“History is a race between education and catastrophe.”

H. G. Wells
<table>
<thead>
<tr>
<th>Country</th>
<th>% of undergraduates in engineering/science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>67%</td>
</tr>
<tr>
<td>China</td>
<td>50%</td>
</tr>
<tr>
<td>France</td>
<td>47%</td>
</tr>
<tr>
<td>US</td>
<td>15%</td>
</tr>
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</table>
CenSSIS Research and Education Pipeline

- ERC vision to inspire students
- Operates at all levels
- Sustained involvement with students
- Program synergies
Curricular Innovations: CenSSIS Education
Works at All Levels

Engineering Profession

Continuing Ed.

Grad. SSI Topics “Distributed University”

Upper-class Intro to SSI Undergrad Research

Fresh Hi-Tech Tools&Toys CenSSIS Scholars

K-12 Outreach

NU RPI

MGH RPI

MSKCC LLNL

INL WHOI

BU UPRM

MSKCC WHOI
Graduate Curriculum
"Distributed University"

- Provosts’ agreement (2001): students can take courses at any partner university based on tuition at home university

- Implementation: “Special Topics” registration at home university

- 58 cross-university course registrations since program inception
Distributed Graduate Courses

- **NU**: ECE G398: Remote Sensing: Wave-Based Sensing (Ratilal) F’05

- **BU / NU**: Boston-area CenSSIS courses

- **RPI**: ECSE-6963: Biological Image Analysis (Roysam) Voice-annotated PowerPoint with “E-Office hour” F’02, F’03, F’04 – Course has been revised as “Biological Microscopy” and will be offered in F’06
Upper Class Undergraduate Programs
NU: ECE1467 “Intro to SSI”, W’02, W’03, Sp’04, Sp’06
- Team-taught: D. Brooks, C. DiMarzio in first three years – D. Brooks, E. Miller this year
- Guest lectures by Roy and Rappaport
- Students applied theory to real data using MVT Toolbox

BU: SC500 “Intro to SSI,” Sp’03, Sp’04, Sp’06
- Prof. Bahaa Saleh

RPI: ECSE4963 “Intro to SSI,” Sp’03, ’04, ’05, Sp’06
- Prof. Roysam and Prof. Thomenius

UPRM: “Intro to SSI” Seminar Series, Sp’04
“Intro to SSI”: Taking Data
Undergraduate Research
Undergraduate Research Paths

- CenSSIS UROP and other supported research
- Coops / Workstudy
- Volunteers / CenSSIS Scholars
- Capstone / Honors Adjuncts
- REU / LSAMP / AAMU
  - New Programs Began Summer 05
  - Alabama A&M and Northeast LSAMP
Undergraduate Research Involvement

Number of Students

Year 1: Other 10, REU 5
Year 2: Other 20, REU 5
Year 3: Other 30, REU 10
Year 4: Other 40, REU 15
Year 5: Other 50, REU 20
Year 6: Other 60, REU 25
CenSSIS Summer ’05 Students at NU’s Marine Science Center
CenSSIS/AAMU Students, Gregory Stargell and Daryl Williams
Working on their CenSSIS/AAMU Summer Projects related to
Optical Detection of Subsurface Vibrations
| Educ p1 | B. Roysam (RPI)  
B. Yazici (RPI) | CenSSIS Educational Component at RPI |
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Educ p2</td>
<td>B. Campbell (BU)</td>
</tr>
<tr>
<td>Educ p3</td>
<td>K. Matarrese (BU)</td>
</tr>
<tr>
<td>Educ p4</td>
<td>J. Matloff (BU)</td>
</tr>
</tbody>
</table>
| Educ p5 | S. Baum (NU)  
Stephen Wong (North Quincy HS)  
Dan Mahr (Phillips Exeter Academy) | Developing FDTD Code While Teaching High School Science |
| Educ p6 | Seth Baum (NU) | Subsurface Imaging-Themed Computer Games and Machine Activities |
| Educ p7 | Claire Duggan (NU) | CenSSIS - K-12 – Outreach Programs – RET and Young Scholars |
| Educ p8 | Hadi Esiely Barrera (UPRM) | CenSSIS Educational Component at UPRM |
Freshman Programs
CenSSIS Scholars Program

- Incoming freshmen identified and invited to apply for book vouchers
- 36 participants across four universities, 2005-2006 (129 total since 2002)
- Continuing Scholars as mentors
- Broadly representative
  - 50% women, 30% minority
- Involved in HTT&T Lab, seminars, field trips, research, K-12 outreach, REU Program
CenSSIS Scholar Mentor, Sean Sullivan working in the Optical Science Laboratory at NU
High-Tech Tools and Toys Lab

- Subsurface discovery lab for freshman
- In place at all four universities
- Expanded to two sections at NU (taught by Ratilal)
- Tool for outreach
CenSSIS RA/TA Heidy Sierra Gil from UPRM working in the NU HTT&TL
CenSSIS Scholars involved in K-12 Outreach:
HTT&TL for Society of Black Engineers
CenSSIS Pipeline

- 7 UPRM students entered Ph. D. programs at NU, BU and RPI in past 3 years
  - Heidi Sierra worked as RA/TA – on HTT&TL

- SSI course students attracted into CenSSIS research and graduate school

- 50+ undergraduates involved in research

- 36 freshman and upperclass CenSSIS Scholars attending CenSSIS activities

- K-12 Connections
CenSSIS Graduate Student, Vanessa Ortiz and her PhD Advisor, Prof. Badri Roysam of RPI in the Confocal Microscope Lab at RPI
“RISING ABOVE THE GATHERING STORM”
Number one action item = increase America’s talent pool by improving K-12 science and mathematics education.

1) For Teachers
   - Summer Institutes
   - Science and mathematics master’s programs
   - AP and pre-AP training
   - K-12 curriculum materials modeled on world-class standards

2) For Students
   - Statewide specialty math/science high schools
   - Inquiry-based learning
   - Summer internships and research opportunities
CenSSIS Response to K-12 Challenge

- Research Experiences for Teachers
- Young Scholars Program
- Collaboration with the NU-GK12 PLUS
- CenSSIS Scholars K-12 outreach
- Summer institutes
- Museums
Goal: “Strengthening the skills of 250,000 current teachers through summer institute training programs…” (Rising Above the Gathering Storm)

- Provide participants with an extended research/design experience
- Build a collaborative teacher/professor community
- Develop leadership skills of participants
- Share best practices
Goal: “Providing students with summer internships and research opportunities” (Gathering Storm)

- The Young Scholars Program complements our teacher-focused efforts.

- Twenty High School students are selected each year to spend six weeks working in collaboration with University graduate students and faculty.
The 2005 Young Scholars
Goal: “Increasing the number of students in AP ... from 1.2 million to 4.5 million by 2010.” (Gathering Storm)

→ **Experiencing**
  Expose students to university life, make them aware of opportunities available after high school.

→ **Believing**
  Help students set goals

→ **Achieving**
  Learn necessary steps to achieve these goals
Seth Baum is working with Health Careers Academy physics students, providing content assistance and introducing them to the world of sensing and imaging.
CenSSIS Scholars

- K-12 classroom support
- Annual Model Bridge Competition
  Boston Society of Civil Engineers (ASCE)
- Local Science Fair judging
- Assisted with the RET and Young Scholars Programs
- Summer Engineering Program
- Troy Children’s Museum CenSSIS displays
Diversity in CenSSIS

Paula G. Leventman, Ph.D.
CenSSIS Diversity Coordinator
Northeastern University

April 4, 2006
Strategic Planning Process to Increase Diversity

- Diversity Goals
- Strategic Activities
- Needed Resources
- Responsibility & Accountability
- Evaluation
Strategies

- Faculty
- Graduate
- Undergraduate
- K-12
- Continuous assessment

systems thinking perspective
The number of CenSSIS female faculty doubled by Year 3 and tripled by Year 6.
The number of CenSSIS minority faculty more than doubled from Year 1 to Year 6.
<table>
<thead>
<tr>
<th>Year</th>
<th>NU</th>
<th>BU</th>
<th>RPI</th>
<th>UPRM</th>
<th>Total # Female</th>
<th>Total Number</th>
<th>Percent Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year One Numbers</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>40</td>
<td>23</td>
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<tr>
<td>Year Three Numbers</td>
<td>13</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>28</td>
<td>100</td>
<td>28</td>
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<tr>
<td>Year Six Numbers</td>
<td>17</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>34</td>
<td>111</td>
<td>31</td>
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<tr>
<td>Year Ten Goal</td>
<td>20</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>42</td>
<td>115</td>
<td>35</td>
</tr>
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</table>

The number of CenSSIS female graduate students more than tripled from Year 1 to Year 6.
### CenSSIS Minority Graduate Students

<table>
<thead>
<tr>
<th></th>
<th>Year Four Numbers</th>
<th>Year Five Numbers</th>
<th>Year Six</th>
<th>Year Ten Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>NU</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>BU</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>RPI</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>UPRM</td>
<td>7</td>
<td>16</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Total # Minority</td>
<td>10</td>
<td>24</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>Total #</td>
<td>112</td>
<td>100</td>
<td>111</td>
<td>115</td>
</tr>
<tr>
<td>% minority w/o UPRM</td>
<td>8</td>
<td>24</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>% minority w/o UPRM</td>
<td>3</td>
<td>10</td>
<td>15</td>
<td>17</td>
</tr>
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</table>

The percent of minority graduate students tripled from Year 4 to Year 6 due to gains at NU and UPRM.
• CenSSIS Scholars

Launched in Year 3 to provide enrichment and diversity to freshman student streams across the 4 CenSSIS partners

In Year 6, there are 32 freshman students across the university partners: 16 are female, 9 are minority

• Evaluation Focus Group

Overall consensus among Scholars and Mentors that the program was beneficial and should be continued
CenSSIS Research Experiences for Undergraduates (REU) Program

- Strategic activity to increase the numbers of women and minority students in the CenSSIS graduate student pipeline
- 10 week paid lab experience, weekly seminars, field trips

- Summer 2002  8 slots  4 female  3 minority
- Summer 2003  8 slots  3 female  4 minority
- Summer 2004  11 slots  5 female  6 minority
- Summer 2005  18 slots  8 female  13 minority
Evaluation of 2005 REU Program

Student ratings on a five point scale
(5=excellent, 4=good, 3=fair, 2=poor, 1=very poor)

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
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<tbody>
<tr>
<td>Overall experience</td>
<td>4.6</td>
</tr>
<tr>
<td>Laboratory environment</td>
<td>4.6</td>
</tr>
<tr>
<td>Quality of relationships with faculty</td>
<td>4.4</td>
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<tr>
<td>Quality of relationships with grad students</td>
<td>4.8</td>
</tr>
<tr>
<td>Quality of relationships with other undergrad students</td>
<td>4.7</td>
</tr>
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</table>

By the end of the summer program, 17 of the 18 students said they were now planning to go on to graduate school.

These are very high ratings, even higher than in previous years.
Partnerships for Diversity

- **CenSSIS Year 3**
  - Morehouse College
  - DiMarzio & Rockward

- **CenSSIS Year 4**
  - Spelman College
  - Kaeli & Hale

- **CenSSIS Year 6**
  - Alabama Agricultural and Mechanical University (AAMU)
    - Murray & Kuktarev
  
  Northeast Louis Stokes Alliances for Minority Participation (NE LSAMP)
  - University of Massachusetts-Amherst
  - Northeastern University
  - University of Rhode Island
  - University of Connecticut
  - Worcester Polytechnic Institute
  - Hicks
## CenSSIS Undergraduate Students

### Year 5

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Female</th>
<th>Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>NU</td>
<td>32</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>BU</td>
<td>19</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>RPI</td>
<td>14</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>UPRM</td>
<td>14</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Spelman Morehouse, Alabama A&amp;M</td>
<td>10</td>
<td>7</td>
<td>10</td>
</tr>
</tbody>
</table>

**Total #**

|        | 89    | 37     | 26       |

**Percent**

|        | 42    | 29     |

**% w/o UPRM, Spelman Morehouse Alabama A&M**

|        | 41    | 8      |

### Year 6

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Female</th>
<th>Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>NU</td>
<td>42</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>BU</td>
<td>22</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>RPI</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>UPRM</td>
<td>19</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Spelman Morehouse, Alabama A&amp;M</td>
<td>9</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

**Total #**

|        | 96    | 38     | 41       |

**Percent**

|        | 41    | 43     |

**% w/o UPRM, Spelman Morehouse Alabama A&M**

|        | 38    | 19     |

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**DIVERSITY IS POSSIBLE**