ASSESSING THE MOBILE COMPUTING PILOT PROGRAM: A COLLEGE-WIDE INITIATIVE

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ASSESSING THE MOBILE COMPUTING PILOT PROGRAM: A COLLEGE-WIDE INITIATIVE

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Objectives

• To evaluate the impact of teaching with wireless laptops in a collaborative setting on student performance, specifically related to problem solving.

• To evaluate the impact of teaching with wireless laptops in a collaborative setting on faculty workload, pedagogy, and amount of material delivered.

• To identify the technical challenges using wireless technology in the classroom have for students, faculty, and technical staff.

• To measure satisfaction of students, faculty and technical staff with the use of this technology in academic settings.
Computer Ownership Among Incoming College of Engineering Freshmen

- Percentage of students bringing computers
- Percentage of students bringing laptops

Year | Percent
--- | ---
1998 | 75
1999 | 85
2000 | 90
2001 | 91.6
2002 | 95.9
2003 | 98
2004 | 97.4
2005 | 98.7

1998-2005
### Courses Involved

<table>
<thead>
<tr>
<th></th>
<th>General Ed</th>
<th>Engineering Courses</th>
<th>Totals</th>
</tr>
</thead>
</table>
|                  | • Introduction to Engineering  
• Introduction to Computing  
• Foundations of Technical Graphics  
• Calculus I  
• Calculus II  
• Calculus III | • Bio Engr:  
• Computer Methods in Bio Engr  
• Bioinstrumentation  
• Intro to Surface Water Quality Modeling  
• Watershed Monitoring  
• Computer Methods Biomedical  
• Chemical Engr:  
• Chemical Process Principles  
• Chemical Engineering Lab I  
• Chemical Engineering Lab II  
• Chemical Engineering Design I  
• **Computer Science:** Programming Java |        |
| **Fall 2001**    | 6                                                                           | 0                                                                                   | 6      |
| **Fall 2002**    | 8                                                                           | 0                                                                                   | 8      |
| **Fall 2003**    | 7                                                                           | 3                                                                                   | 10     |
| **Fall 2004**    | 6                                                                           | 10                                                                                  | 16     |
Reason Chose Specific Laptop

- Features
- Cost
- Recommended
- Brand
- Weight

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell</td>
<td>76%</td>
<td>38%</td>
<td>21%</td>
</tr>
<tr>
<td>IBM</td>
<td>9%</td>
<td>41%</td>
<td>59%</td>
</tr>
<tr>
<td>Other</td>
<td>16%</td>
<td>21%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Fall 2002 | Fall 2003 | Fall 2004
Assessment Methods

• Direct Assessment:
  – Rubrics
  – Tests
  – Student course work

• Indirect Assessment:
  – Faculty surveys three times per semester
  – Student surveys end of semester
20 out of 32 (62%) faculty said preparation time for the laptop section was increased because of modifications. Modifications included:

- Adding the Internet and problem-solving during class time.
- Adding more complex, real world, or technically challenging problems to class time activities.
- Incorporating appropriate software into the classroom activities (e.g. MAPLE, Excel, MATLAB, etc).
- Including teamwork and cooperative or pair learning as part of their pedagogy.
Maple®, a modern engineering tool for visualizing concepts in calculus used to solve real world problems. In laptop sections students "Let Maple® do the sketching". As a result, they have the advantage of seeing the surfaces immediately in front of them as the instructor discusses the process.

<table>
<thead>
<tr>
<th>TEST Questions</th>
<th>Regular Section</th>
<th>Laptop Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two integrals - one used substitution and the other used integration by parts.</td>
<td>85%</td>
<td>87%</td>
</tr>
<tr>
<td>Convergence of a series</td>
<td>80%</td>
<td>76%</td>
</tr>
<tr>
<td>Students’ graphic understanding of the relationships among the integral, right sums and left sums for increasing functions</td>
<td>79%</td>
<td>94%</td>
</tr>
<tr>
<td>Graph the region between two curves and find the area between them. Then revolve this region about a line to produce a solid of revolution - find the volume of this solid.</td>
<td>69%</td>
<td>79%</td>
</tr>
</tbody>
</table>
### Students’ Opinions About Maple®

<table>
<thead>
<tr>
<th>Regular Sections</th>
<th>Laptop Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>• “Maple is a waste of my time.”</td>
<td>• “At first, maple was aggravating. But after I learned how to use it, it helped my comprehension of the material.”</td>
</tr>
<tr>
<td>• “Made the material more confusing.”</td>
<td>• “I really enjoyed having MAPLE on my computer. It made the class much easier not to have to head off to separate labs.”</td>
</tr>
<tr>
<td>• “It is horrible way to submit homework.”</td>
<td>• “It allowed us to work with more complex problems and find solutions faster.”</td>
</tr>
<tr>
<td>• “It hurt my learning.”</td>
<td>• “Maple is a pain to do, but I like the program.”</td>
</tr>
<tr>
<td>• “I hate Maple! It is quite positively the absolute worst program on campus.”</td>
<td></td>
</tr>
</tbody>
</table>
Enhanced Problem Solving

• Faculty in Calculus, Computer Science and other courses have used the laptop program to incorporate the lab section of the course into the lecture portion.

• Assessment results show that students had significant gains over non-laptop sections in regard to:
  • the visualization of the course content,
  • several dimensions of problem solving,
  • graphics and computer-aided drawing,
  • programming was improved in several sections.
Increased Student Engagement

- 73% ... laptops improved communication with classmates.
- 96% ... laptop gave them freedom to work any place, any time.
- 87% ... classes were positively affected by integrating laptops.
- 84% ... experience increased comfort in using their laptops.
- 85% ... laptops make learning more enjoyable.
- 84% ... in-class use of instructional technology stimulated learning.
- 99% ....prefer to use own computers than lab computers
Increased Course Pace & Variety: Faculty Perception

- Increased Pace
- Greater Variety
- Increased Depth

Fall 2003
Spr 2004
Fall 2004
## Enhanced Learning: Students and Faculty Agree

<table>
<thead>
<tr>
<th></th>
<th>Laptop Students: % “Agree” Fall 2003</th>
<th>Laptop Students: % “Agree” Fall 2004</th>
<th>Faculty: % “Agree” Fall 2003</th>
<th>Faculty: % “Agree” Fall 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptops in class enhance learning</td>
<td>77%</td>
<td>77%</td>
<td>77%</td>
<td>79%</td>
</tr>
<tr>
<td>Laptops are a distraction</td>
<td>12%</td>
<td>19%</td>
<td>15%</td>
<td>21%</td>
</tr>
<tr>
<td>Laptops make learning more enjoyable</td>
<td>90%</td>
<td>86%</td>
<td>62%</td>
<td>79%</td>
</tr>
<tr>
<td>Use of instructional technology made learning more stimulating</td>
<td>84%</td>
<td>85%</td>
<td>69%</td>
<td>77%</td>
</tr>
<tr>
<td>Laptops improved communication with instructor</td>
<td>61%</td>
<td>54%</td>
<td>23%</td>
<td>36%</td>
</tr>
</tbody>
</table>
Decreased Technical Challenges

Faculty
• At the beginning of the semester, 60% spent time on technical issues.
• At the end of the semester,
  – 29% did not change plans due to technical difficulties
  – 32% changed plans once a month
  – 26% changed plans more than once a month
  – 72% said technical issues were solved in a timely manner

Empowered Students to solve own problems
• Developed Course: students installed software and learned about technical issues.
• The number of logged help calls for the laptop program decreased by more than half after developed this course.
Decreased Technical Challenges

Laptop Cart
- Problem: Battery Life Dictated Scheduling Use
- Electricity: With 30 laptops/cart, used 30 amps
  - Needed dedicated circuit just for cart

Wireless Connectivity
- ComTech added newer, faster standards:
  - Increased network speed, increased number that could be connected via wireless in a given area
  - Resulted in fewer problems due to better login management, an increase in the number of access points, and a diversified mix of wireless standards.
Conclusions

• Students are bringing more IBM Laptops than Dell Laptops; other brands are gaining popularity.

• The main reason students chose their computers was the features of the computer. Cost, recommendations and brand loyalty were next. Few based decisions on weight or advertisement.

• Technical staff dedicated to program important element to address challenges.
Conclusions

• Students and faculty had positive attitudes about the use of technology in courses.

• Assessing the impact of technology on student learning needed to wait until the faculty had further developed their courses using the technology.
  – Faculty support (from experienced peers, pedagogical consultants, graduate students) is vital for genuine course transformation.

• In courses where faculty had sound pedagogical use of technology, found enhanced learning.