Active Learning Using Tablet PCs

Aaron Addison and Gina Frey
GIS Center and The Teaching Center
Outline

- Introduction to HP grants – Higher Education Initiative
- Use of Tablet PC’s in Solid state Chemistry – results of two years
- Use of Tablet PCs in GIS
2005 HP Grant

- Chemistry – 20 tablet PC laptops
- Primary focus was to increase students’ understanding of the techniques and skills used by practicing scientists
  - Physical Chemistry laboratory and Solid-State and Materials course
- Implemented the use of current computer-modeling software in the solid-state course (W.E. Buhro)
  - Visualize complex 3D crystal structures, modify the crystal structure, simulate experimental data based on modified structure
- Tablet PCs allowed us to introduce in-class active-learning exercises for chemical modeling
Integration of Multiple Tools

Chemistry 465 – Professor Bill Buhro
Performance Results for Solid-state Course

- Scores on homework using PowderCell
  - Spring 06: scores improved with in-class training of software over software demonstration only
  - Spring 07: Scores improved over Spring 06, when additional in-class exercises were added
- In-class student participation and interactivity increased when the use of tablet PCs were introduced
- In spring 07, when additional in-class exercises were added, the increased student participation and in-class dialogue continued even in the non-tablet PC sessions.
Observations – Solid-state Courses

- Students’ responses to the in-class exercises, specifically the refinement exercises
  - Students helped one another improve their refinements
  - Obtained a final class refinement better than the instructor’s
- Improved understanding of the refinement method
  - Obtained excellent refinements on out-of-class homework exercises
  - Same assignments on which students often never achieve converged refinement, in previous years.
  - The instructor is convinced that in-class exercises are the only way to teach students computational methods and tools
- Continuation of the increased student participation in the class in non-tablet PC sessions
  - In-class exercises encouraged the students to discuss ideas and issues among themselves and with the instructor
  - Set up an expectation of class discussion between all parties
Attitudinal Results for Solid-state Course

In post-semester surveys, students rated the following items on a scale from strongly agree (=5) to strongly disagree (=1) over both years (06 and 07):

<table>
<thead>
<tr>
<th>Survey Statement</th>
<th>Average response</th>
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<tbody>
<tr>
<td>Incorporating Tablet PC exercises into lecture improved my understanding of course content</td>
<td>4.6</td>
</tr>
<tr>
<td>Understood concepts more easily using in-class computer exercises than waiting until after class to try the computer exercises</td>
<td>4.1</td>
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<tr>
<td>More comfortable working computer exercises outside of class because used tablet in class</td>
<td>4.31 4.1 in ‘06 4.5 in ‘07</td>
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Student Quotes from Solid-state Course

Quotes are from the anonymous post-semester survey:

- Using the PC’s took a lot of class time, but it likely saved a tremendous amount of out-of-class time. The balance was positive.
- Very helpful. Would have been extremely difficult to motivate myself to learn how to use PowderCell on my own if we didn’t have the practice in class.
- I felt the PowderCell program helped me to visualize common structures displayed throughout the course. I also don’t see how refinements could have been done without the computers.
- I appreciated the ability to look at 3D images while talking about the structure……[instead of] confused 2D images that all start to look alike in my notes.
- I think I would have had an extremely difficult time with PowderCell if we did not use the tablet PCs in class.
- They [the tablet PCs] really helped me visualize things that he [the professor] described in class.
Summary of Results: Solid-State

- Students integrate software use better via in-class exercises versus outside use only.

- Combining learning the software with learning the concepts increases students’ ability to understand the software and the concepts being taught.
2007 HP Grant

- We want to apply this teaching methodology to the application of GIS in many disciplines and computer-supported collaborative-learning (CSCL) software in Education.

- Education, GIS, History, and The Teaching Center – 40 tablet PC laptops

- For in-class use by students. Interested in using for GIS, contact Aaron Addison. Interested in using for other applications, contact Gina Frey.
What is GIS?

“The philosophy that location is important”

“The intersection of people and place”
What is GIS?

- Geospatial Information Systems
  - Hardware
  - Software
  - Software
  - Networks
  - Training
  - People

- GIS is a powerful tool for
  - Perform certain tasks more efficiently
  - Scenario analysis
  - Inquiry based learning
What GIS is NOT

- GIS is not a single software package
- GIS is not a “project”
- GIS is not always the best tool for the job
Why use GIS?

- Provides a visual framework for gathering, analyzing, interpreting, distributing and utilizing geospatial (and non-geospatial) data.

- GIS is a tool for communication

- GIS is a tool for predictive modeling
2004 Presidential Election Results

- **Bush**: 62,040,606 Popular, 286 Electoral
- **Kerry**: 59,028,109 Popular, 252 Electoral

Washington University Teaching Center and GIS
2004 Presidential Results by County
Spatial Information – Center of Application Innovation & Excellence

RESEARCH

Integration
Application
Collaboration
Communication

Application
Innovation & Excellence

Lab Space
Software Licensing
Services
Computing

Conferences
Training Seminars
Instruction
Curriculum

INFRASTRUCTURE

EDUCATION
What about the tablet PCs?

- Tablet PCs a key piece of infrastructure
  - Increase in GIS resources
  - Ability to take computers to any classroom
  - Ability to use “touch” interface
    - Data collection
    - Navigation
  - Collaboration opportunities
Current Use

- Earth & Planetary Science
  - Tablets used for teaching GIS labs (J. Smith)

- History
  - To be used in History – International Development (T. Parsons)

- Computer Science
  - To be used in computer programming studio with applications to GIS (C. Grimm)
Future Use

- Anthropology
- Social Work
- Art / Architecture
- University Libraries
- Business & Economics
- Medical School
- Engineering
- Biology
- ???
Assessment

Informal

- Students generally have positive experience
- Instructors pleased to be able to bring GIS to traditional classroom

Formal

- Development of survey underway with TTC
Who to Contact?

Aaron Addison
University GIS Coordinator
aaddison@wustl.edu