Classroom Presenter: Supporting Active Learning with the Tablet PC

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Draw a picture of something from Singapore

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Where are you from?

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Classroom Presenter

- Distributed, Tablet PC based application
  - Instructor, Display, and Student machines
- Synchronized navigation of slide deck
- Instructor ink distributed in real time to all machines
- Student Submissions
  - Slides used to distribute activities to students
  - Student work sent to instructor
  - Instructor shows student work on the public display

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Student Attention vs. Time

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Classroom Technology Vision

Study goals

- Are devices effective in achieving instructor specific classroom goals in the traditional lecture model
- What patterns of behavior arise when devices are deployed for classroom interaction

Why use computers to support good pedagogy?

- Improved logistics and reduced overhead
- Electronic activities allow digital integration
  - Efficient display to class
  - Digital record
- Specific operations
  - Anonymous display and submission
  - Aggregation and analysis
- Natural extension of instructor presentation system

Pedagogical Goals

- Strategies used to support classroom instruction
- Influence material being presented
  - Classroom Assessments
- Active Learning
  - Discovery
- Class contributions
  - Misconceptions
  - Collective Brainstorming

Discovery

- Students make a discovery from an activity
- “Learning by doing”
- Distribution of activity allow students to independently find the result

Find a topological order for the following graph
Problem Introduction

• In an algorithms class, give students an instance of the problem to work with before presenting algorithms
• Ensure students understand the problem
• Students are more engaged in finding algorithms after they have worked on a problem
• Students discover aspects of the problem

Determine the LCS of the following strings

BARTHOLEMEWSIMPSON
Krustytheclown

Submissions

Collective Brainstorm

• Generate student ideas for discussion
• Build a list of ideas
• Analyze and evaluate responses

Special problem: Large Size

• List at least three problems trees must face (& solve) because of their large sizes.
  1.
  2.
  3.
• Additional:

Challenge problems

• Competition in getting solutions
• Simultaneous work
• Submission and discussion
Handwriting Recognition: Identify the following words

Recognition results

What technology provides

- Digital domain
  - Support for archiving, distribution, and analysis
- Integration with lecture
  - Allows display with data projector
- Efficiency
  - Reducing overhead of distribution and collection
- Simultaneity
  - All students work at once to increase contribution rates
- Additional communication channels
  - Easier to express certain ideas
  - Overcomes communication barriers

Classroom Deployment Experience

- University of Washington,
  - Algorithms, Data Structures, Software Engineering, Digital Design, Environmental Science
- UCSD, UCSC, Virginia Tech, UMass, MIT
- Preliminary Evaluation
  - Surveys, interviews, observation
  - Activity Logs
  - Activity analysis

Classroom Usage

- Data from Undergraduate Algorithms course (Fall 2005)
- 7 lectures, 26 activities
- Logged data – timings of submissions

Time per activity

- Work time – students working independently on activities
- Discussion time – student work shown on public display
- Average work time 4:29
- Average display time 2:41
**Participation rates**

- Percentage of students present submitting work
  - Min 11%, Max 100%, Average 69%
- Some students would answer without submitting
- Resubmission common

**Display Behavior**

- Average of 6.15 slides per activity displayed (minimum of 1, maximum of 18)
- Common pattern – show one or two for most of the time, and quickly show the others

**Collaboration**

- One to three students per tablet
- Interaction between students often encouraged
- Instructors would survey and occasionally comment on student work during activity phase
- Student work a key part of classroom discussion
Anonymity
• Work displayed on public display without any identification
• Limited information about submission displayed on the instructor machine
• Anonymous display valued by the students
• Students often believe the instructor can identify their work
• Tagging behavior observed

Results
• Comparison with classroom networks
  – Classroom response systems, “clickers”
  – Single display of rich responses versus aggregated, finite responses
  – Support different classroom goals
• Comparison with paper based activities
  – Most of the activities can be done with paper!
  – Improved logistics with digital system
  – Anonymity
  – Key is ability to incorporate into public display

Tutored Video Instruction with Classroom Interaction
• Joint project between University of Washington, Beihang University, and Microsoft Research Asia
• Offer an undergraduate course using Tutored Video Instruction
• University of Washington course CSE 421

Motivation
• Offer undergraduate algorithms course at Beihang
  – Instructor is in Seattle
  – Time difference prevented a synchronous distance course

Tutored Video Instruction
• Base course on facilitated use of recorded materials
• Materials recorded from a live class
• Facilitator guides discussion around materials
• Gibbons, Science 1977

Course Mechanics
• Lecture recorded at UW using ConferenceXP
• Teaching Assistants at Beihang replayed lecture
• Stopped the video regular for questions and explanation
Role of Tablet PCs

- UW Course used Tablet PCs once a week
- Beihang class had Tablet PCs for activities for every lecture
  - Students did activities
  - Teaching Assistants displayed the solutions
- Teaching Assistants used Classroom Presenter to write on slides to enhance explanations

Teaching Assistant Ink

- Dealing with the assumption of no equal weight edges:
- Force the edge weights to be distinct
- Add small quantities to the weight
- Give a tie-breaking rule for equal weight edges

Student Submissions

- Problem Reduction Examples
- Design a Dynamic Programming Algorithm for Billboard Placement
- Use Dynamic Programming to find a solution
- What is the optimal solution?
- Find a satisfying truth assignment
- Find a truth assignment for the given clauses
- No TRUTH

Evaluation

- Students performed well
  - Exam results, observation
- Positive survey results
- Interactive class sessions
- Technology and logistics successful
- No negative impact on UW class
- Tablets PCs / Classroom Presenter considered to be very important

Any questions?

- Richard Anderson, anderson@cs.washington.edu
- Classroom Presenter
  - www.cs.washington.edu/education/dl/presenter/
- Classroom Presenter 3 downloads
- CSE 421 Course Web and videos
  - www.cs.washington.edu/education/courses/cse421/06au/
- Acknowledgement
  - Microsoft Research External Research and Programs
  - Microsoft Research Asia
  - Beihang University

Classroom Presenter 3

- Beta Release – April 1
- Current builds available from
- Most significant changes from CP2
  - Support for TCP/IP networking
  - Improved ink support
  - Direct import of PPT (no need for deckbuilder)
- For more information contact
  - Richard Anderson, anderson@cs.washington.edu