The Center for Collaborative Technologies

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Center for Collaborative Technologies at University of Washington

- UW center funded to develop technologies to support education and other collaborative scenarios
- http://cct.cs.washington.edu
- Extend functionality of ConferenceXP
  - Diagnostics, Security, Remote management, HDTV integration, . . .
- Build community of users and developers
- Deploy ConferenceXP in new scenarios
  - International education
  - Developing world

Research in Educational Technology

- How can computing technology enhance education?
  - Focus on classroom instruction
- Challenges:
  - Extending reach of education
  - Increasing interaction
  - Addressing problems of scale
  - Facilitating expression of ideas

Past and Current Research Projects

- Video conferencing distance education
- UW PMP
- DISC
- ConferenceXP
- Center for Collaborative Technologies
- Presentation systems
- Classroom interaction systems
- Tutored Video Instruction
- UW CC TVI Project
- Beihang TVI project
- Digital StudyHall

Research Approach

- Deployment driven
  - Classroom use
  - Technology development and promotion
- Goals and success criteria
  - Adoption of technology and methodology
  - Influence educational practice
- This is a model that has been working for us
  - Target specific deployments that are innovative in some dimensions

Today’s Talk

- Distance Learning and Video Confereenced Classes
- Tutored Video Instruction
- Lessons learned and remaining challenges
- Future projects
Video Conferenced Teaching

- Multi-site internet based audio-video conferencing
- UW PMP Program
  - Site-to-site courses between UW and Microsoft since Winter 1997
  - www.cs.washington.edu/education/dl/course_index.html
  - Master’s level courses
  - Goal: interaction across sites
  - Various technologies have been used since the program was introduced

Video conferencing in the PMP

  - Polycom + Netmeeting for PPT and SmartBoard
- MSR DISC Project
  - Target: UW, CMU, UCB, Brown graduate class
  - Spring 2002
- MSR ConferenceXP
  - Since Spring 2003
  - UW, MSR, UCB, UCSD
  - Ed Lazowska, Steve Mauer

Distributed Classroom (DISC)

- High quality, low latency video to support interactive classes
- High bandwidth internet video conferencing
  - Internet2
  - Multicast
- Single machine deployment
  - High end PC
  - Performance limit: handling multiple high resolutions video streams
- Innovative presentation tools

Initial Deployment (PMP spring 2002)

- What went wrong
  - Technology and systems failures
  - Multicast networking
  - High cost of interruptions
  - Loss of trust
  - Room configuration issues
  - Lack of control of lecture room
  - Production quality
- Meta lesson
  - Learn more from failures than from successes

ConferenceXP

- Redevelopment of DISC
- Deployment in UW PMP since Spring 2003
  - High reliability (with unicast backup)
  - Supporting tools for archiving and replay
- Scalability to four site courses
  - UW, UCB, Microsoft, UCSD
Classroom Presenter
• Support electronic slides and digital ink
• Initially developed for whiteboard integration of DISC
  – “PowerPoint sucks the life out of a lecture”, EDL
• Tablet PC application
  – Digital ink overlay on slide images
  – Feature set aimed at lecture presentation
• Component of ConferenceXP or stand alone application

Ink based presentation
• Tablet PC Inking on images
• Simple pen based controls
• Whiteboard, slide extension
• Multiple views — instructor/display
  — (dual monitor)
• Multiple slides decks with filmstrip navigation
• Instructor notes

Development of ConferenceXP
• Microsoft Research Project
• Goal: support universities work in distance education and collaboration (on Windows)
• ConferenceXP
  – Internet based video conferencing
  – Extensible platform allowing integration of other data streams
  – Shared source
• Microsoft ended work on project in 2007
  – Established Center for Collaborative Technologies through competitive process to continue stewardship of ConferenceXP

Center for Collaborative Technologies at University of Washington
• UW center funded for continued work on ConferenceXP Platform
  – http://cct.cs.washington.edu
• Extend functionality of ConferenceXP
  – Diagnostics, Security, Remote management, HDTV integration, . . .
• Build community of users and developers
• Deploy ConferenceXP in new scenarios
  – International education
  – Developing world

Projects related to distance learning
• Working with archived lectures
• Large library of recorded lectures available
  – Autumn 2006 Algorithms class recorded with close talking microphones
• Lecture indexing — support text search of speech (and slides and ink)
  – Language modeling necessary (train on algorithms or CS content)
• Lecture summarization
  – Classify lecture episodes
    • Support for lecture browsing
    • Feedback to the instructor
• Lightweight lecture capture

Tutored Video Instruction
• Video recorded lectures shown with facilitator
  – Original model: lectures stopped by students for discussion
  – Peer tutors
• Developed by Jim Gibbons at Stanford University
• Positive results reported in Science [1977]
UW TVI Projects

• Introductory programming
  – Address community college articulation
  – Experiment with alternate approaches to introductory computing instruction
• UW – Beihang Algorithms course
  – Offering of CSE 421 in China
• Digital StudyHall
  – Primary education in rural India

Tutored Video Instruction

• Recorded lecture materials
  – Generally based on live classes
• Class model
  – Lecture playback alternating with facilitator led discussion
  – Facilitation models
    • Gibbons: Peer instruction
    • Active facilitation

UW – Community College

• Lectures recorded from UW Intro Class
• Shown at CCs with local instructors as facilitators
• Project lasted 3 years, involving 9 CCs
  • Phase I
    – Materials from live lecture, centralized grading, management from UW
  • Phase II
    – Studio created materials, CC grading

Lessons Learned

• Results were mixed
• Complicated institutional relationships
  – CC students concerned about competition with UW students
• Facilitation model
  – Did not achieve peer facilitation
  – Co-teaching a more accurate description
  – Facilitators wanted external support (e.g., classroom activities)
• Program helped with instructor development

UW-Beihang CSE 421

• Offer course based on UW course in Beijing
• UW Instructor could not give the course in Beijing
• Scheduling prevented live course offering
  – 1:30 pm Seattle, 4:30 am Beijing
  – Materials captured from live classes
• Tutored Video Instruction
  – Slides, talking head, digital ink

Building on UW – CC experience

• Instructor visits to Beijing to set up project
• Balanced role of institutions
  – Materials from UW
  – Grading, administration at Beihang
  – Have students view the course as a Beihang course
• Training of facilitators
• Support materials
Use of course technology

• UW Course
  – Classroom Presenter for digital ink on slides
  – Students used Tablet PCs once a week for active learning
    • Students write answers on slides, send them to the instructor
    • Instructor previews results and selects slides to display to the class

Activity Examples

Find a topological order for the following graph

Find a minimum value cut

Determine the LCS of the following strings

Results

• Offering successful
  – Technology, institutional relationship
• Cross-cultural issues
  – English language materials were comprehensible
  – Classroom discussion primarily in Chinese
• Facilitation model
  – Significant support for facilitators
  – Classroom activities successful (and popular)
  – Facilitators innovative and reproduced some of the instruction
  – Interactive and informal classroom atmosphere

Digital StudyHall

• Affiliated Project
• Randy Wang, Paul Javid (MSRI, Bangalore)
• Richard Anderson, Tom Anderson (UW)
• Tutored Video Instruction for primary education in rural India
• YouTube + Netflix

Key components

• A people’s database
• Mediation based pedagogy
• Hub and spoke model
• Content distribution by DVD
Status: network of hubs and spokes
- Operational hubs in Lucknow, Bangalore, Pune
- Hub starting in Calcutta, Bangladesh starting in December
- Each hub works with a number of poor village or slum schools

What we’ve learned from all of this
- Value of electronic materials in the process of classroom instruction
- Tools for teaching
  - Teacher and students drive the process
  - Flexible and unpredictable use
- Importance of high reliability
  - And attention to address issues
- Broader context – interplay of technology and other issues

Deployment Driven Research
- Development and deployment of educational technology
- Internal
  - Working with our own classes
  - Opportunity to innovate
  - Pressure to make things work
- External
  - Broad range of ideas
  - User suggestions
  - Feedback on ideas

Directions for future work
- Enhanced lecture capture and analysis
- Speech to text with domain specific training for lecture indexing
- Lecture summarization
- Lightweight capture

Richer content support for slide based lectures
- Slide model: static content or build slide animations
- Challenge: provide a richer model of content for dynamic presentations
  - Particular domain of interest: mathematical content
- Starting points
  - Instructor notes
  - Structured Interaction Presentations (SIP) [Wolfman]
  - Geometrical structure for slides

Facilitation for Tutored Video Instruction
- Teaching with recorded materials
  - Peer discussion vs. co-teaching
- Regular interruptions for active learning
- Beihang class
  - Facilitators made substantial use of Classroom Presenter
  - Activity structure was successful
- Projects
  - Develop integrated TVI replay, presentation and classroom interaction tools
  - Refine methodology for combining active learning with TVI
  - Replay tools for DSH scenarios
Classroom Accessibility

- Opportunities in electronic classroom for greater accessibility
- Classroom capture and archiving
- Real time interpretation
  - Captioning/Screen reading
- Input
  - Instant messaging, shared whiteboard, custom input facilities
- Collaborative work with Richard Ladner

Enabling Access to STEM Education

- Development of ConferenceXP Platform
- Establish as a shared source project
- System enhancements
  - Multicast diagnostics
  - Security
- Deployments
  - Collaboration with Microsoft sponsored Latin America Virtual Institute
  - UW Professional Master’s Program

Center for Collaborative Technologies

- Multi-site classes with ConferenceXP
- Challenges
  - Networking issues (firewall, multicast)
  - Identifying cases where interactivity is needed
  - Time zones
    - West Coast US (6:00 pm) & China (9:00 am)
- Short term
  - Pilot tests with Chinese Universities
  - Latin America Virtual Institute
  - International guest lectures for UW CSE PMP Class (spring)

Domains of Special Interest

- Higher Education
- International Courses
- Developing World
- Global Health

International Education

- Tremendous challenges faced in education in the developing world
- Technology supported instruction that is cost-realistic and sustainable
- Digital StudyHall
  - India, Bangladesh, Eritrea, . . .
- Interactive, Facilitated Video Instruction
- Low cost multi-person interaction
  - E.g., Multimouse
- Deployment issues
  - Lack of power, network connectivity
Global Health

• Strong regional opportunity
• Distance education to support medical education
• Alternate models of video based instruction

For more information

• Richard Anderson
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• Classroom Presenter
  – http://education.cs.washington.edu/dl/presenter/
• Center for Collaborative Technologies at UW
  – http://cct.cs.washington.edu/
• Digital StudyHall
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  – Digital StudyHall: Paul Javid (pjavid@cs.washington.edu), Tom Anderson (tom@cs.washington.edu)
  – Classroom Accessibility: Richard Ladner (ladner@cs.washington.edu)

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