Expanding the reach of education through technology

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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

Tutored Video Instruction
UW CC TVI Project
Beihang TVI project

Structured Interaction Presentations (SIP)
Student submissions with CP

Classroom Feedback System
CATs for CS1

Classroom interaction systems

Presentation systems

Video conferenced distance education
UW PMP
DISC
ConferenceIP
Center for Collaborative Technologies

Classroom Presenter 3.0
Classroom Presenter 2.0

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 Conferenced Classes
• Tutored Video Instruction
• Lessons learned and remaining challenges
• Future projects

Video Conferenced Teaching

• Multi-site internet based audio-video conferencing
• UW Master’s Program
  – Site-to-site courses between UW and Microsoft since Winter 1997
  – www.cs.washington.edu/education/d/course_index.html
  – Master’s level courses
  – Goal: interaction across sites
    – Approximate single classroom
    – Various technologies have been used since the program was introduced
Distance Classes in UW CSE Master’s Program

• Initial phase
  – Polycom + Netmeeting for PPT and SmartBoard
• MSR DISC Project
  – Target: UW, CMU, UCB, Brown graduate class
  – Spring 2002
• ConferenceXP
  – Since Spring 2003
    – UW, MSR, UCB, UCSD

Initial Challenges (Spring 2002)

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

ConferenceXP

• 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

Success in distance classes

• Goals
  – Real time interaction between sites
  – High quality video
• Challenges
  – High bandwidth connections
  – Classroom Audio
  – Establishing a pattern of interaction
Hardware Multicast

- Technology bet (2001)
  - Multicast networking to support multisite courses
  - Substantial bandwidth savings
  - Multicast not uniformly supported

Dealing with multicast problems

- Reflector service
  - Plug in unicast to replace multicast
- Used as backup in our courses
- Solution when connecting to networks without multicast

Going International

- March 29, 2008, LACCIR Meeting
  - Latin American and Caribbean Collaboration for ICT Research
- Seattle and University of Chile, Santiago, Chile
- Seminar presentation
- CXP Unicast reflector

Masters class, UW - Pakistan

- Masters class
  - University of Washington
  - Lahore University of Management Science
  - Microsoft
- Computing for the Developing world

Technical Challenges

- Ensuring adequate bandwidth
  - Limited bandwidth to Pakistan
  - Reliability
  - Multicast
  - Ensuring this did not compromise UW-MS class
  - Limited time to prepare

Fred’s whiteboard
Basic PMP setup (2 sites)

3-way setup for UW, MS, LUMS

Use of Classroom Presenter
- Tablet PC based presentation and classroom interaction system
- Ink based presentation
- Classroom Activities

Classroom Presenter

Classroom Activities

Project status
- High connectivity 9 out of 10 classes
  - One lecture originated from Pakistan
  - Only failure was on the UW-Microsoft Link (which also brought down UW-Pakistan)
- Improving audio (microphone issues)
- Participation of students from Pakistan
  - Student submissions
  - Questions and discussions
- Multiple rounds of audio communication
Key lessons

- Participants must have incentive for a distance course
- Instructor must make an effort to create multisite interaction
- Active participants at remote site help
- Time zones and scheduling are major issues

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

UW-Beihang Algorithms class

- 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

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]

Involvement with Remote Site

- Set up visit
  - Met with Teaching Assistants
  - Tested all technology
  - Trained Teaching Assistants in facilitation
  - Gave classes to students to demonstrate technology and TVI
- Midterm visit
  - Observed classes
  - Gave lecture without recorded video
- Regular communication with Teaching Assistants
- Data collection
Course Delivery

- Applications displayed
  - Webviewer for video replay
  - Classroom Presenter
- Teaching Assistants would show video or show CP for inking on slides or classroom interaction

Summary of Project 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

Language Issues

- Lectures delivered in English
  - Language exposure consider to be a positive side effect of the course
- Teaching assistants facilitated in English
  - But discussions were generally in Chinese
- Students reported using lectures outside of class
- Instructor observations from site visit
  - Chinese students had substantially more English listening than speaking experience
  - Recorded lectures did contain some colloquial usage and cultural specific references which were lost

Facilitation

- Support provided for facilitators
  - Lecture notes
  - Activities
- Facilitators invested a larger effort in preparation
  - Studying videos
  - Planning how to cover content
- Active facilitation
  - Worked through lecture examples
  - Led activities
  - Asked questions to students

Example: facilitators working through example from lecture slides

Classroom Activities

- Tablet PC supported activities
  - Student submission model
  - Used for every lecture
- Technology generally successful
- Considered very positive by students
  - High rate of participation
- Provided a structure for active learning

Classroom Environment

- Contrast to traditional large lecture class
- Highly interactive class
  - Interaction episodes measured by observation logs and videos of Beihang classes
  - Average of 13 interaction episodes per class, 10 with students speaking
- UW class averaged about 20 interaction episodes per equivalent length of time
- Beihang episodes averaged a greater number of rounds of communication
- Class atmosphere was informal
Results

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Key components

• A people’s database
• Mediation based pedagogy
• Hub and spoke model
• Content distribution by DVD

Digital StudyHall

• Affiliated Project
• Collaboration with Randy Wang in Lucknow
• Tutored Video Instruction for primary education in rural India
• YouTube + Netflix

Status: network of hubs and spokes

• Operational hubs in Lucknow, Calcutta, Pune, and Bangladesh
• 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
For more information

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