Expanding the reach of education through technology

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

Research Approach

- Deployment driven
  - Classroom use
  - Technology development and promotion

- Goals and success criteria
  - Adoption of technology and methodology
  - Influence educational practice

- Target specific deployments
  - Innovate in some aspect of deployment

Today’s Talk

- Distance Learning and Video Conferenced Classes
- Tutored Video Instruction
- Digital Study Hall
- Educational Technology for Low Resource Environments

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/dl/course_index.html](http://www.cs.washington.edu/education/dl/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
  - Room configuration issues
  - Lack of control of lecture room
  - Production quality
  - Meta lesson
  - Learn more from failures than from successes

- How to Fail at VideoConferenced Teaching
  - Microsoft Faculty Summit 2003
  - Anderson & Beavers

Success in distance classes

- Goals
  - Real time interaction between sites
  - High quality video
- Challenges
  - High bandwidth connections
    - Multicast vs. Unicast
  - Classroom Audio
  - Establishing a pattern of interaction
Going International

- March 29, 2008, LACCIR Meeting
  - Latin American and Caribbean Collaboration for ICT Research
- Seattle and University of Chile, Santiago, Chile
- Seminar presentation
  - October 15, 2008
- 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

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

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

Video recorded lectures shown with facilitator
- Original model: lectures stopped by students for discussion
- Developed by Jim Gibbons at Stanford University
- Positive results reported in Science [1977]
**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-Beihang Algorithms Class**

- Offer a course in Beijing based on UW course
- UW instructor could not teach the course in China
  - Scheduling prevented a live course offering
    - 1:30 pm in Seattle is 4:30 am in Beijing
  - Materials captured from live class
- Tutored Video Instruction
  - Slides, talking head, digital ink

**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

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Digital StudyHall
- Affiliated Project
- Collaboration with Randy Wang in Lucknow
- 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, Calcutta, Pune, and Bangladesh
- Each hub works with a number of poor village or slum schools

Digital StudyHall Evaluation Study

- Classroom study starts July 2009
  - Two year study
- 12 schools in Uttar Pradesh
  - 12 DSH Classrooms
  - 12 Traditional Classrooms
- Evaluate Learning gains through pretest/posttest
- Classroom observations
- Study impact on teachers

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

Educational Technology for Low Resource Environments

- Facilitated Video Instruction
  - Biggest opportunity to enhance expertise
- Synchronous Distance
  - Limited applications – but some specific cases of interest
  - Classroom capture
- Classroom Computing
  - Computer lab and individual devices
- Computing Education
  - Lack of technical literacy is a limiting factor

Facilitated Video Instruction

- Recorded video with a facilitator
  - Take advantage of expertise
  - Facilitator has very important role
- Applicable to a broad range of educational domains
  - Primary and secondary
  - Health
  - Agriculture
  - Vocational
  - College

Facilitated Video Instruction

- Applicability for low resource environments
  - Low cost
    - Replay (TV + DVD)
    - Digital Video + PC based editing
  - Locally created content
- Key components
  - Facilitation methodology
  - Support for facilitator
  - Program structure
    - Content creation through delivery
- Technology
  - Video production tool chain
  - Content distribution
  - Delivery
  - Feedback and monitoring
**Synchronous Distance Education**

- Bandwidth is a significant issue
  - Low bandwidth + high cost
- May be relevant for institutional outreach programs
  - Arvind Eye Hospital, Tamil Nadu, India
  - International medical education
- Positive side effect: classroom capture
- Risk: Driven by need to justify infrastructure – not for educational needs

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**Classroom Computing**

- School based computing
  - Risk: deployments leading educational goals
  - Challenge: maximize benefits of “computers for schools initiatives”
- Models
  - Low cost educational devices
    - Classmate, OLPC, Asus eee, ...
  - Shared use
  - Multipoint
  - School server

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**Computing Education**

- Shortage of trained professionals
- Hostile Computing Ecosystem
  - Very high virus infection
  - Poorly administered machines
- Solutions
  - Computing practices and maintenance

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**For more information**

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- Center for Collaborative Technologies at UW
  - http://cct.cs.washington.edu/
- Digital StudyHall
  - http://dsh.cs.washington.edu/

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**Acknowledgements**

- Support from Microsoft Research, National Science Foundation, HP, Ford, UW CSE