Computing for Development at MSR India

Kentaro Toyama
Assistant Managing Director
Microsoft Research India

TEDC 2006
Ruaha, Tanzania

Outline

Introduction

Multi-Mouse for Education

Digital StudyHall

Conclusions

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Multi-Mouse for Education

Digital StudyHall

Conclusions

MSR India

- Established January 2005
- Goals
  - World-class academic research
  - Contributions to Microsoft products and businesses
  - Support growth of research programs in India and elsewhere
- Six research areas
  - Cryptography
  - Digital Geographics
  - Hardware, Communications, and Systems
  - Multilingual Systems
  - Rigorous Software Engineering
  - Technology for Emerging Markets
- Currently 35 full-time staff
- Collaborations with government, academia, industry, and NGOs

Microsoft Research India
Sadashivnagar, Bangalore

“Technology for Emerging Markets”

Computer-skills camp in Nakalabande, Bangalore
(Stree Jagruti Samiti, St. Joseph’s College , MSR India)

- Understand potential technology users in poor communities:
  - E.g., urban domestic labourers
  - E.g., rural entrepreneurs
- Interdisciplinary work
  - Researchers with social science and technical backgrounds
- Research ways in which computing could contribute to socio-economic development of poor communities worldwide.

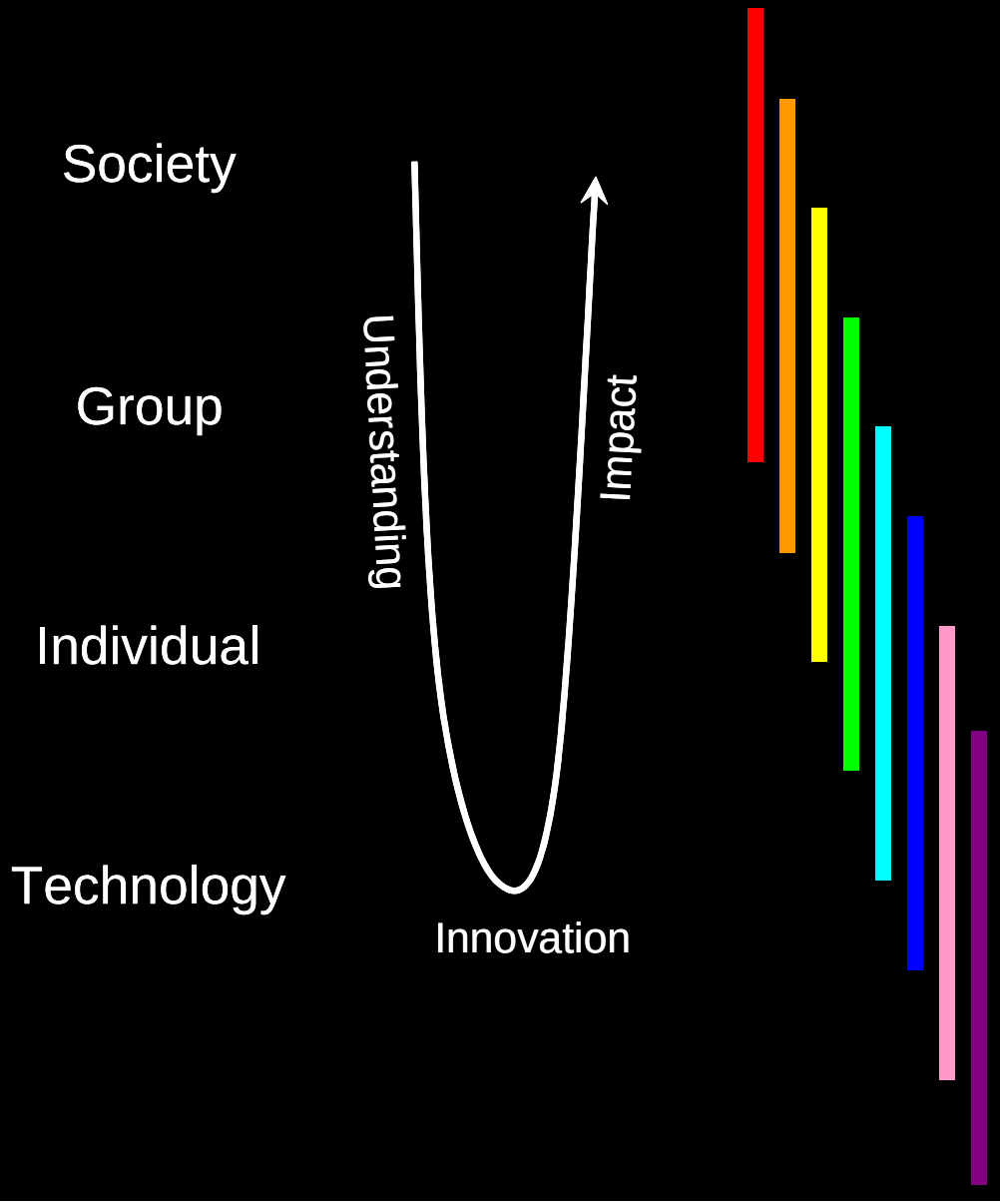
“Kids in the developing world need the newest technology, especially really rugged hardware and innovative software.”

- Nicholas Negroponte (One Laptop Per Child website, 2005)

“The world's poorest two billion people desperately need healthcare, not laptops.”

– Bill Gates (WRI Conference, Seattle, 2000)

Interdisciplinary Research



Aishwarya Lakshmi Ratan
- Public Administration and International Development

Jonathan Donner
- Communications

Nimmi Rangaswamy
- Social Anthropology

Deepak Menon
- Business Management

Rajesh Veeraraghavan
- Computer Science and Economics

Indrani Medhi
- Design

Kentaro Toyama
- Computer Science

Randy Wang
- Computer Science

Udai Singh Pawar
- Physics

Mobile-Phone Data Entry

Feature phones as “bar-code” readers for data-entry in rural microfinance

Tapan Parikh
Research Intern

Well-Being Map

Transitions between states of wealth in emerging markets

Aishwarya Lakshmi Ratan
Associate Researcher

Urban Consumer

Study of dynanic middle-class consumers in urban emerging markets

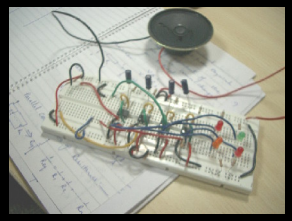
Nimmi Rangaswamy
Associate Researcher

ICT in Agriculture

Experiments with computing and communication systems in agriculture

Rajesh Veeraraghavan
Associate Researcher

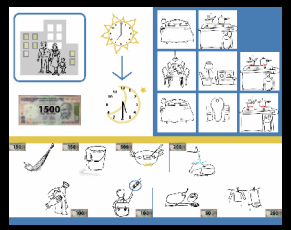
Featherweight E-Book



Very cheap electronic book for child and adult education

Vibhore Goyal
Assistant Researcher

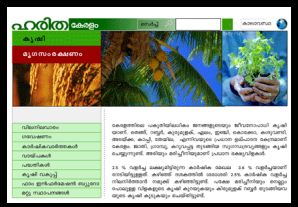
Text-Free UI



UIs without text for users who are illliterate and may never have seen a computer before

Indrani Medhi
Assistant Researcher

Government and Rural IT



The state’s role in rural IT projects, with a focus on Kerala’s Akshaya project

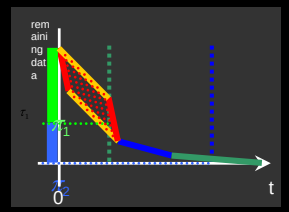
Renee Kuriyan
Research Intern

IT and Microentrepreneurs

Information ecology of small businesses in developing markets

Jonathan Donner
Researcher

Cost-Aware Data Transfer



Cost-aware transfer of data across heterogeneous channels, *e.g.*, for mobiles

Rohan Murty
Research Intern

Multi-Mouse for Education

Udai Singh Pawar

Joyojeet Pal (UC Berkeley)

Kentaro Toyama

Multi-Mouse: Problem

Child labour

Parents uninvolved

Teachers multitasking

Frequent maintenance of PCs required

No toilets

No permanent building

No textbooks

Irrelevant curriculum

No walls

Intermittent electricity

Poor pay for teachers

No supplies

Terrible student-teacher ratio

UPS broken

Heat

Caste discrimination

Teacher absenteeism

Poor retention rates

Many children per computer

Teachers not computer literate

Religious discrimination

Student illness

Students hungry

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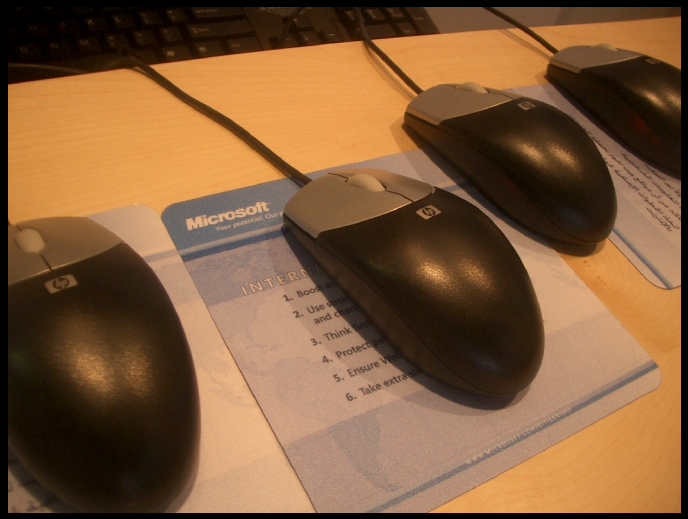
At school after school…

One PC,
many children.

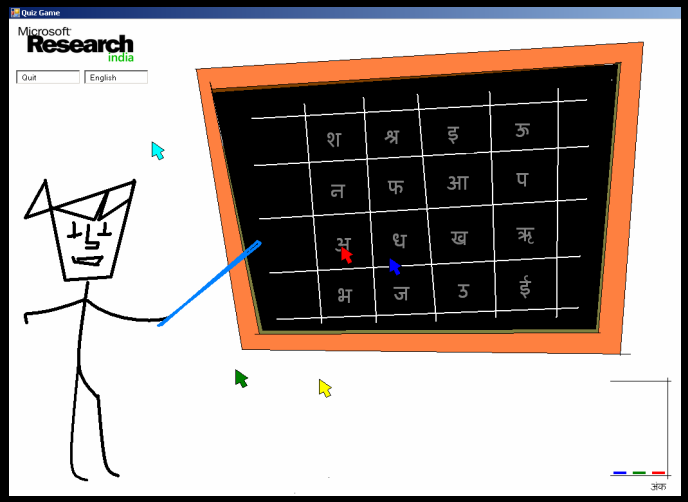
Multi-Mouse: Solution



Provide a mouse for every student

- One cursor for each mouse, with different colours or shapes
- USB mice
  - Have tried up to 20
- Content modified
  - Game-like environment

Multi-Mouse: Demo



Multi-Mouse: Results

Preliminary user studies [ICTD2006]

- Questions
  - Can students understand multi-mouse paradigm?
  - How do children interact with multi-mouse?
  - Does multi-mouse increase engagement?
- Methodology
  - Trials:
    - 20 min single mouse
    - 20 min multi-mouse
    - 10 min free play
  - 3 trials of 6-10 children

Before

Multi-Mouse: Early Results

- Everyone wants a mouse.
  - Girls more likely to share than boys.
- Kids understand multi-mouse immediately.
- All students more engaged for longer periods of time.
  - Even children without mice engage longer.
- Self-reporting is positive.
  - Exception: one student didn't like multi-mouse because of competitiveness

Before

After

Multi-Mouse: Advantages

Incentives aligned

- Cost effective: One computer + 5 mice comes to ~$100 per child.
- Content authors can adapt to paradigm
- Government / administrators can claim better use of computers
- Teachers can keep more students entertained
- Students have more fun (cf., multi-player computer games)

Multi-Mouse: Related Work

- Bier (1991), Hourcade (1999)
  - Technical issues of multiple mice
  - “Single Display Groupware”
- Inkpen et al. (1995)
  - 2-student education scenario
  - Cursor control toggles between two mice
- Bricker (1998)
  - 3-person collaborative “education”
- Greenberg et al. (2004)
  - Multiple mice for collaborative work

Multi-Mouse: Current Work

Current work

- Software SDK for content writers to be released in August 2006
- Technical features to maximize educational value of multi-mouse
- More user studies to test pedagogical value
- Pilots with NGOs in India
- Hoping to disseminate beyond India

New hypothesis: Better for education than one PC per child?

Digital StudyHall

Randy Wang

Urvashi Sahni (StudyHall, Lucknow)

Digital StudyHall: Problem

Poor teaching quality in rural schools

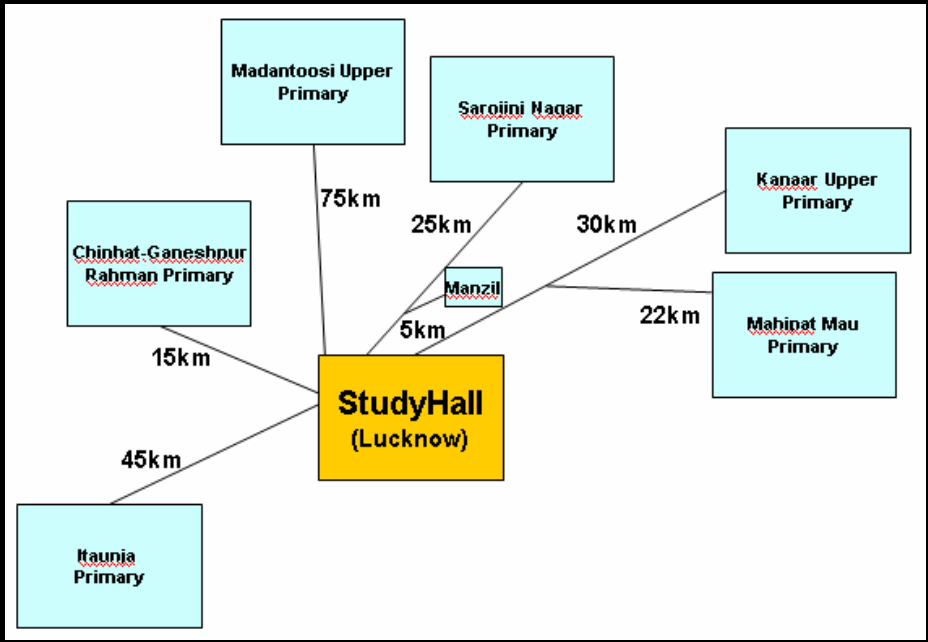
Rural school in Chinhat, Uttar Pradesh

Digital StudyHall: Problem

Good teachers drawn to city with higher salaries and better environments

Urvashi's StudyHall private school in Lucknow

Digital StudyHall: Problem



Distances from Lucknow to neighboring villages

Technology-heavy "distance learning" typically fails:

- Infrastructure: poor connectivity
- Economics: equipment and operational costs high
- Language differences
- Social issues: teacher support and student motivation

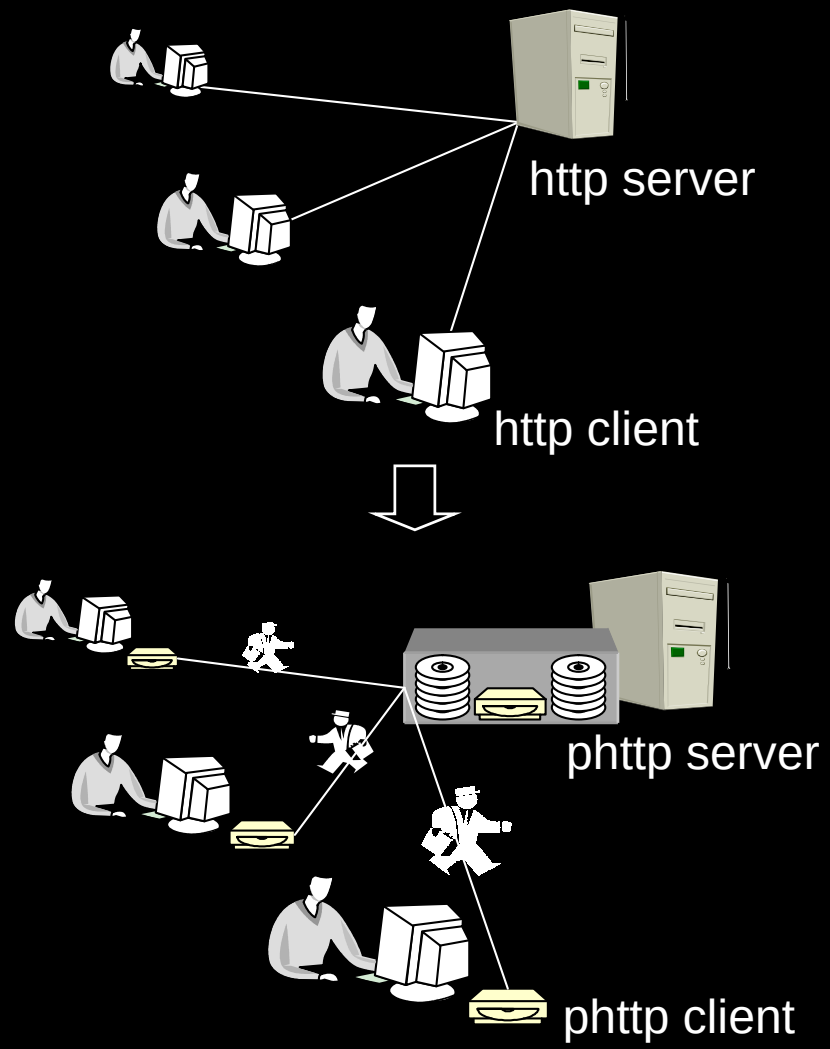
Digital StudyHall: Solution

Develop content involving good urban teachers

Deliver content by post on DVD

- Very high latency, but
- Very high bandwidth

Emphasize pedagogy for rural teachers



Digital StudyHall: Scheme

?

Urvashi's StudyHall private school in Lucknow

Rural school near Lucknow

- Teachers excellent
- Language: English
- Students advanced
- CEB curriculum

- Teachers undertrained
- Language: Hindi
- Students behind
- Government-mandated curriculum

Differences too great!!!

Digital StudyHall: Scheme

- Good teachers teach poor urban students in urban area
  - Content recorded
- Recorded content used in poor rural schools

Handles differences in…

- Teacher qualification
- Language
- Student background
- Text books

Digital StudyHall: Technical

Content recording in Lucknow private school, afternoon outreach

End-to-end systems approach:

- Cheap, simple video-recording of lectures
- Replicated multimedia database with web-based search front-end
- Teacher-mediated playback in classroom

Digital StudyHall: Delivery

Rural teachers encouraged to use video content as springboard.

Teacher using recorded content in Madantoosi village

Digital StudyHall: Early Results

Students can hold elementary conversations in English after 7 months in some schools

- Starting with zero English
- School with dedicated teachers
- Teachers “carbon copy” both content and methodology from headquarters faithfully

UW professor visiting Kannar school

Digital StudyHall: Early Results

UW professor visiting afternoon outreach class

Students can understand English, mostly without aid, but struggle to speak on their own

- Starting with zero English
- School with dedicated teachers
- Teachers adopt teaching style of good teachers
- Class length only 2-3 hours per day

Digital StudyHall: Early Results

Students barely able to understand English, and cannot speak.

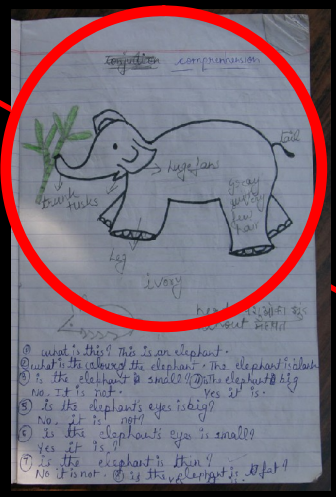
- Time spent in class very low

Teacher is able to teach English without himself being proficient.

- Digital content is sufficient for teacher to bootstrap own ability
- Teacher uses material, copies, embellishes

UW professor visiting Madantoosi village

Unexpected Results

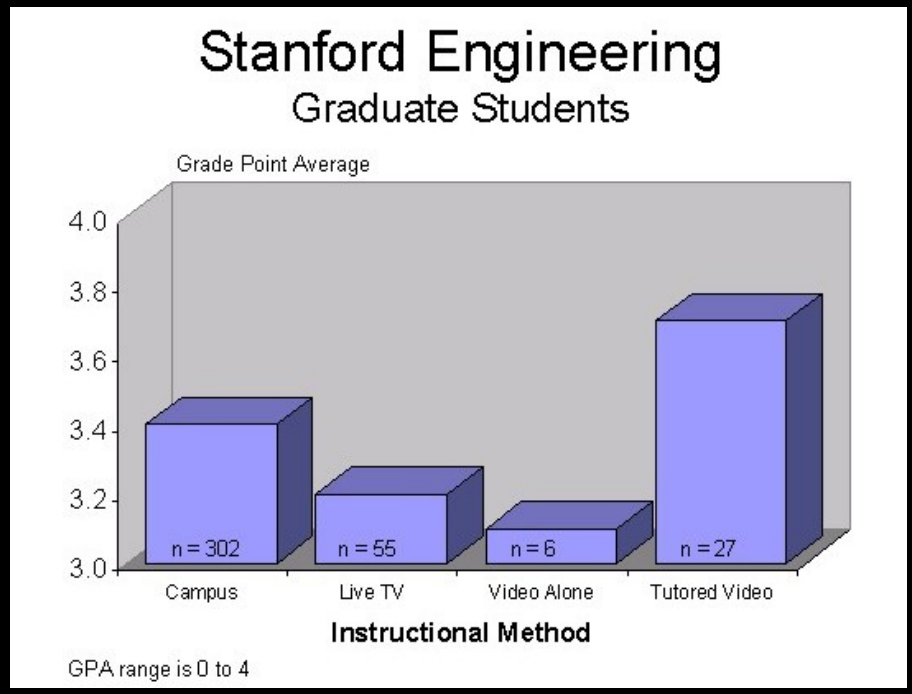


- Motivated teacher took own initiative
- Used the system to train/teach self
- Abandoned crutch during live lessons
- “Graduated” teachers: the ultimate success

Digital StudyHall: Related Work

Tutored Video Instruction (1977)
- Stanford distance-education project
- Mediated video watching better than live lecture?

e-Sagu (2004)
- Agricultural prescription for farmers
- Digital photos of crops delivered by post



Results from TVI experiments

Digital StudyHall: Current Work

- Replication at other locations; explore differences:
  - Relationship between hub and spoke schools
  - Language issues
  - Teacher/student ability
- Peer teaching
  - Teacher presence unreliable
  - Harness strengths of good students
- Further focus on cost-realism

Peer teaching when teachers absent

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Broad Conclusions

Technology has a place, but…

- Not a guaranteed benefit
- Attention to social context essential

Cost-consciousness critical for long-term or wide-scale success.

- Absolute cost
- Relative cost

Constraints of developing world may give rise to technology or methodology that applies to developed world.

ICTD 2006 Conference

IEEE/ACM International Conference on
Information and Communication Technologies and Development

May 25-26, 2006, Berkeley, CA

Co-organized by MSR India, UC Berkeley, IIIT-Bangalore, MIT, CMU

Focus on rigorous academic work, with all papers double-blind peer-reviewed

Establishing a community of academic researchers in technology for development

Next one likely in December 2007, location to be decided

UC Berkeley, site of ICTD 2006

Thank you!

http://research.microsoft.com/research/tem