Some NMEICT Initiatives at IIT Bombay

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Preamble: Goals & Metrics of TEL

• As ET researchers, we typically focus on interventions, create prototypes, and do pilot implementations on small scale.

• What do we usually measure? – Learning, Engagement, …
• For larger scale projects, we need more / other metrics.

• TEL (Technology Enhanced Learning) metrics:
  – Effectiveness: learning, perceived usefulness.
  – Attractiveness: engagement, fun.
  – Efficiency: ease of access for teachers/students, scaling to numbers.
  – Accessibility: inclusiveness, handling diversity.

• The main role of the technology is one or more of the above.
• Keep these in mind as we discuss the following projects.
National Mission on Education Through ICT (NMEICT)

- Policy: Government of India is committed to supporting education through effective use of ICT.
- www.sakshat.ac.in
- Launched in 2009.
- 100+ projects, 20+ institutions, Rs 6000 crore (~1 billion USD)
- All content under Open Education Resources
- Technology developed under FOSS
- Research in Technology for Education
NMEICT Project – T10KT

Teach 10000 Teachers (T10KT) features

- 310 remote centers
- 2-4 week long teacher training workshops in Engg
- 22 workshops – total of 125,000 teachers trained
- Blended mode – Live lectures and interactions, with remote / online labs and assignments

http://www.it.iitb.ac.in/nmeict/
T10KT: Some details

- Workshops on content
  - Programming, Computer networks, Thermodynamics, …

- Workshops on teaching and research
  - Educational Technology for Engineering Teachers (ET4ET)
  - Research Methods in Educational Technology (RMET)
  - Technical Communication

- MOOC
  - Courses through IITBx - [www.iitbombayx.in](http://www.iitbombayx.in)
  - 3 courses, 50 colleges, 35,000 students, so far
  - Course on Educational Technology starts Jan 7th, 2016.
T10KT: Some learnings

• Findings:
  – Possible to do large scale professional development, with sound pedagogy, using technology for scaling.
    • Intention to use from ET4ET, Action research from RMET.
  – Focus on pedagogy is more important than technology.
    • We know this intuitively but we also showed it from data.
  – Immersivity and pertinency are key drivers.
    • Authentic activities and immersion close to real context is crucial.
  – Early shift of ownership is crucial for sustainability.

• Research work
  – PhD thesis on model for sustainability and scale.
  – PhD thesis on analysis of T10KT participants.
NMEICT – Computer tools literacy

www.spoken-tutorial.org
10 min self-learning video tutorials
300+ tutorials developed
22 Indian Languages
~900K students trained in 4 years

www.fossee.in
Specific workshops in open-source tools such as Scilab, Python
Spoken-Tutorials: some details

• SELF Workshops (Spoken Tutorial based Education and Learning through Free FOSS study) on:
  – Basic IT skills – Use of Libre Office suite, Browsers, …
  – Programming – C++, Java, Python, …
  – Employability – Blender, InkSpace, …

• From July 2011 till date:
  – ~2000 institutions participating
  – ~22000 trainings conducted
  – ~995000 students trained
  – Community participation for organizing trainings and creating contents
Spoken-Tutorials: Some learnings

• Findings:
  – Feedback of 25,000 participants:
    • using 5 point Likert Scale (from very bad to very good).
    • 80% of the participants rate the quality of instructional content as “good” or “very good”.
    • 75% rate the overall quality of SELF workshops to be “good” or “very good”.
    • 60% rate the topics of study as “useful” or “very useful”.

• Research work:
  – PhD thesis on effectiveness of teaching-learning of programming through Spoken Tutorials.
  – Post-doc opportunities also available.
**e-Yantra**

- **Teaching Professionals**: Mentor students, Train in theory + hands-on project, Provide methodology for **Project Based Learning** (PBL)

- **Students**: Create infrastructure; Align course + project outcomes with practicals

- **Institutes**: Seeding labs: Robotic kits given to colleges

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**e-Yantra Robotics Competition (eYRC)**

**Goal**: Practical orientation Innovative BE Projects

**e-Yantra Lab Setup Initiative (eLSI)**

**Goal**: Create infrastructure, Align course + project outcomes with practicals

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- **Seeding labs**
  - **2012 (Pilot)**: 4,384
  - **2013**: 6,300
  - **2014 (ongoing)**: 12,428

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- **e-Yantra eco-system**
  - Empower teachers
  - Provide innovation platform
NMEICT Projects
Content generation for higher education

http://oscar.iitb.ac.in
500 animations, simulations
Instructional Design workshops

http://www.vlab.co.in
Virtual Labs
OSCAR: Some details

• Interactive animations and simulations for topics:
  – 150 at School level for science and maths.
  – 300 at College level for engineering and science.

• Workshops
  – 12 workshops, 600 people trained.
  – 4 workshops on Instructional Design, 8 on Blender skills.

• Process
  – Several models tried for scaling.
  – Domain-owner model successful.

• Downloads
  – 52,000 downloads from 100 countries over 8 years.
OSCAR: Some learnings

• Findings:
  – Difficult but important to create well-designed visualizations.
    • Example - Attention to aspects of ID, VC, UI, are crucial for usability.
  – For adoption, sustained teacher training is required.
    • Example - Workshop at T4E 2015.

• Research work:
  – PhD thesis on incorporating design principles in creating educational visualizations.
  – PhD thesis on determining the right level of interactivity for a given topic and learning objective.
  – PhD thesis on training instructors to select and use visualizations in their classrooms.
Other IITB Projects
Content and outreach for CS in schools - Computer Masti

- ~400 schools in Academic year 2015-2016
- 500,000 students; 4000 teachers trained since 2009
- 70,000 views (downloads?) from across 140 countries
- [http://www.cse.iitb.ac.in/~sri/ssrvm](http://www.cse.iitb.ac.in/~sri/ssrvm)
Computer Masti: Some details

- **Focus on Thinking process skills:**
  - Step-wise thinking, Logical reasoning, Gathering information, Brainstorming, Mind-mapping, …

- **Thematic integration:**
  - Connection to real-world scenarios, Application of knowledge from other subjects, Application of CM learning to other subjects.

- **Spiral curriculum:**
  - Topics are revisited in successive years at greater depth.

- **Guided-discovery based teaching-learning.**
Computer Masti: Some learnings

• It is not enough to write a “good” curriculum, we need to write textbooks.

• It is not enough to write “good” textbooks, we need to do teacher training.

• It is not enough to do teacher training once a year, we need to do periodic visits to schools.

• It is not enough to support the implementation, we need to do measurements.

• Schools don’t always buy / use / pay for quality!
Reflections: Sustainability at scale

• Content creation, such as OSCAR, Vlabs:
  – Difficult to scale and sustain without continuous influx of funds.
  – Going beyond download counts requires systematic outreach.

• Outreach, such as T10KT, Spoken-Tutorials:
  – Scale to large numbers; order of magnitude more funding.
  – Sustainability depends on continued funding, trainers, teams, …

• Self-sustaining, such as Computer Masti:
  – Needs investors willing to take the risk to create a company.
  – Survival depends on business model – customers, market.

The main competition to high-quality products in education sector is, non-use
– Sridhar Rajagopalan, MD, Educational Initiatives
Recommendations

Proposed IITB Model for outreach

Academia

Generates Educational Technology Products

IPR Transfer of Product

Validated by pilot experiments for usability and usefulness

Outreach possible

Yes

No

Revisit product later

Products released in Creative Commons

Not-for-Profit

Create

Group of socially committedHNIs

Create

Supports Education Entrepreneurs

Conduct field experiments for outreach and business model

Business possible

No

Products + support material released in Creative Commons

Yes

Products generated during field experiments are used to support existing users through a community-based, online model

For-Profit Company takes up the product

Existing edu start-ups

Products with validated revenue model

Products without revenue model

S1

S2

Avoid
Upcoming Conferences at IITB

• **LaTiCE 2016** – March 28\(^{th}\) - April 2\(^{nd}\), 2016.
  – Learning and Technology in Computing and Education.

• **ICCE 2016** – November 28\(^{th}\) – December 2\(^{nd}\), 2016
  – International Conference on Computers and Education.

• **T4E 2016** – December 2\(^{nd}\) – December 5\(^{th}\), 2016
  – IEEE International Conference on Technology for Education

• **ICALT 2018** – IEEE Conference on Advanced Learning Technologies

We have put in a lot of effort to get these conferences to India, so that large number of teachers and researchers can attend.

**Don’t Miss Them.**
Openings:
Faculty - Short & long-term visits
Students – PhD / Post-doc in ET

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Technology Enabled Learning of Thinking Skills
  – Process skills of pan-domain applicability
  • Engineering Design, Modeling, Estimation
  • Data visualization, Representational competence
  • Computational thinking, Problem posing
  • Systems thinking, …

Teacher Professional Development
  • Workshop models, Instruction design, …
Research – sample Ph.D. theses

**TEL of Thinking Skills**

- Development and assessment of engineering design competencies
- Spatial skills such as mental rotation of 3D objects
- Graph interpretation and data visualization skills
- Scientific abilities such as macro-micro thinking (Physics)
- Systems thinking (Biology), problem-posing (Computer Science), debugging and trouble-shooting (Computer Science).

**Frameworks for content and skill development**

- Framework for scaffolding programming to Hindi-medium learners
- Interactivity enhancing factors for Visualizations in engineering
- Development of guidelines to design and evaluate Virtual Labs
- Collaborative approach for programming using Spoken Tutorials

**Teacher use of ET**

- Teacher integration of technology in classroom
- Framework for customized visualization selection and integration

**Automation of ET systems**

- Automated generation and evaluation of assessment instrument
- Constructing customized textbooks from lecture transcripts