ICT in Education: A Case of Singapore’s Strategies in Scaling Implementation

Longkai WU
National Institute of Education (NIE)
Nanyang Technological University
Singapore
Tenets

• Background Singapore’s Master Plan
• A Case of Implementation and Scaling of ICT
Need for ICT in Ed Masterplans

• Human capital development – key national focus

• Alignment of economic, manpower & education policies

• ICT in Ed:
  • Preparation for knowledge-based environment
  • Enhance learning experiences

Acknowledgement:
Slides 4-8 are courtesy of Dr Cheah Horn Mun, Former Director, Education Technology Division, Singapore
ICT in Ed Masterplan Journey

Masterplan 1
Building the Foundation

Masterplan 2
2003
Seeding Innovation

Masterplan 3
2009
Strengthening & Scaling
Core ICT Training for all teachers

ICT Infrastructure & Support for all schools

Educational software & resources for relevant subjects

1997: Masterplan 1
Building the Foundation

ICT became an accepted tool for teaching & learning
2003: Masterplan 2
Seeding Innovation

Baseline ICT Standards for all

Established Baseline ICT Standards for pupils

Remaining Schools

Generate innovative practices through schemes

LEAD ICT Schools 15-20% schs

FS@SG 5% schs

Gave autonomy through devolved ICT funds
### ‘Curriculum 2015’ Student Outcomes

<table>
<thead>
<tr>
<th>Confident Person</th>
<th>Self-directed Learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinks independently</td>
<td>Takes responsibility for own learning</td>
</tr>
<tr>
<td>Communicates effectively</td>
<td>Questions, reflects, perseveres</td>
</tr>
<tr>
<td>Has good inter-personal skills</td>
<td>Uses technology adeptly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concerned Citizen</th>
<th>Active Contributor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is informed about world and local affairs</td>
<td>Exercises initiative and takes risks</td>
</tr>
<tr>
<td>Empathises with and respects others</td>
<td>Is adaptable, innovative, resilient</td>
</tr>
<tr>
<td>Participates actively</td>
<td>Aims for high standards</td>
</tr>
</tbody>
</table>

---

**mp3 Goal**

Students develop competencies for self-directed and collaborative learning through the effective use of ICT as well as become discerning and responsible ICT users.

**2009: Masterplan 3**

Strengthening and Scaling
Necessary Transformation

1\textsuperscript{st} Masterplan
Build Foundation

- ICT supporting curriculum

2\textsuperscript{nd} Masterplan
Seed Innovation

- ICT integrated into curriculum & assessment

3\textsuperscript{rd} Masterplan
Strengthen & Scale

- ICT embedded into syllabuses & teaching guides

Curriculum, & Assessment

- Core training for all teachers and school leaders

Professional Development

- Differentiated Prof Development
- Consultancy to school leaders

Research & Development

- Spearheading R&D efforts in collaboration with industry & schools
- Seeding innovation in schools
- Translating research to influence classroom practices

Infrastructure for Learning

- Central provision to equip all schools
- One-size-fits-all
- Flexible provision to suit schools needs
- Closer alignment to curriculum changes and schools needs
• How MP3 strategies have been enacted on the ground?
  • A case study: Implementation and Scaling of Seamless Learning from one school to more schools
Seamless Learning

• Scale from what to what?
  • From two science teachers to all science teachers in level

• Why scaling?
  • Research study of efficacies showed learning gains in subject matter, positive attitudes to subject learning, new media literacy, good learning habit – self-directed learning
  • More holistic learning with mobile device as a learning hub to support seamless learning in classroom and outside of classroom
  • Teachers developed constructivist practices
Seamless Learning

• Why is it (or not quite) ready for scaling? *(When to scale?)*
  • Design principles are ready
  • Increased teachers’ awareness of the value of mobile learning principles
  • More design of learning activities is needed
  • Don’t quite have model of balancing needs for mobilized curricula & preparing students for exams
  • But PD models are not quite tested (how to spread it within the school and how can the average teacher take over); the current PD is “expensive”
  • Parents’ concern (e.g., screen size, monitoring students’ mobile use, cyberwellness)

• How to scale?
  • Teacher CoPs
  • Sharing MLE platform, lesson plans, exemplar lesson videos
• The innovation in Coburn (2003) and Clarke and Dede (2009)’s framework

**Depth**
- Effectiveness in students’ learning outcomes (both exam results and attitudes) and teacher’s transformation in pedagogical practices in school N

**Sustainability**
- The innovation was sustainably used and refined in the school N for five years (2009-2014)

**Spread**
- The innovation has scaled up in the grade level, school level and now in cluster level

**Shift in Ownership**
- The school N has taken over ownership by driving the spread of the IBSL innovation within school and across schools

**Evolution**
- The innovation developer is refining the design principles to be more feasible for practitioners
Implementation Design

- **Seeding-Seeded Schools**
  - More Centralized Network with Seeding School Taking the Pivotal Role

- **Cross-School Teacher Community of Practice**
  - To share successes and failures
  - To share resources
  - To reflect teaching practices

- **Systemic Support System**
  - School Principals, HODs of Science and ICT
  - Within-School PLC
  - AED and IT technician support
**Stage 1: Knowledge Acquisition**
- Learning of characteristics of IBSL (especially the effectiveness, simplicity, trialability) through:
  - Researcher’s sharing of study results
  - Lesson observations of EAT’s in school N
  - Lesson co-design with across schools community for P3 lessons with focus on inquiry learning, and use of technology
  - Familiarization of design principles for IBSL lessons

**Stage 2: Curriculum Implementation and Establish the Routine Use of IBSL**
- Improve understanding of IBSL (especially the trialability, compatibility, cost) through:
  - Lesson co-design for P3 topics
  - Lesson implementation with adaptation in pilot class in P3 in respective school
  - Post-observation conversations to reflect upon teaching practices
  - Share the innovative practices with colleagues in schools

**Stage 3: Curriculum Refinement and Integration**
- Advance understanding of IBSL through:
  - Lesson co-design for P4 and lesson revision for P3 topics
  - Another round of lesson implementation in P3 class
  - Lesson adaptation according to students’ needs
  - Collaborate with colleagues within school to refine and integrate the curriculum for better use
  - Take leading role in spreading IBSL in school
Results

- Effectiveness and Observability
  - Students’ improvement in answering open-ended questions

The classroom culture of learning as inquiry

<table>
<thead>
<tr>
<th>Marks</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCQ (4 questions)</td>
<td>5.33 / 8 m</td>
<td>5.66 / 8 m</td>
</tr>
<tr>
<td>OE (3 questions)</td>
<td>2.494 / 6 m</td>
<td>4.069 / 6 m</td>
</tr>
</tbody>
</table>
• Teachers’ Perception of IBSL - Simplicity
  - use of technology
  - student-centered and teacher as facilitator
  - fostering self-directed learner
  - beyond classroom, or in and out of classroom
  - life-long learning
  - 21st century skills
  - enhance students’ interests in science learning
  - fostering students’ critical thinking
  - facilitate collaborative learning

From teacher’s pre- and post-survey
• Teachers’ Perception of IBSL - Compatibility and Feasibility
  • Challenges and Concerns
    • Parents’ buy-in of the use of tablet
    • Technical issues/ technical support from the vendor
    • teacher’s capacity of conducting inquiry-based teaching

• Conditions of sustainable and scalable use
  • My principal/Vice principal has to agree to extend the innovation to other cohort/classes
  • I am willing to use the innovative pedagogy as my routine teaching practice
  • My HOD ICT/Science has to agree to use IBSL for other cohorts/classes

From teachers surveys and interviews
• Teachers’ Implementation of IBSL

- Curriculum Adaptation
- Pedagogical Approach
- Use of Technology
• Teachers’ Adaptation of Curriculum

**Evolution:**
Take more ownership in curriculum development and evolve the curriculum package by integrating other available innovative resources available.

**Refinement:**
Customize the curriculum package according to students’ learning abilities, and schools’ resources.

**Mechanical use:**
Follow the original lesson plan without pondering the rationale of the design and internalizing the curriculum package for own use.

“I enjoyed the lesson co-design a lot. It helps us pedagogically look at how other teachers view the same subject content and come up with ideas of how to teach that particular topic...”
**Teachers’ Differences in Pedagogical Approach**

**Goal-driven teaching approach**
- More questions that target on factual knowledge (e.g. definition of strength).
- Teachers tended to correct the wrong answers or ignore the wrong answers.
- Teachers set experiment procedures and students followed them.

**Constructivist-oriented teaching approach**
- Probe questions to clarify student’s thinking when the teacher received wrong answers.
- Generating arguments when contrasting ideas from students were identified.
- Explicitly address the spirit of inquiry and fair test ideas in experiments.

School A, B, D

School C, E
• **Teachers’ Differences in Use of Technology**

Future direction: Use of **MyDesk apps** and **complementary ICT tools** for seamless learning

Explore use of different ICT-enabled strategies and tools
E.g. use of Edmodo and Socrative for formative assessment

Limited repertoire of ICT-enabled strategies
E.g. only use videos to explaining concepts

**School’s status of use of technology**

School A, B

School C

School D, E
• Teachers’ content knowledge or their confidence in their content knowledge;
• Teachers’ beliefs in teaching and learning, as well as their beliefs in technology for learning;
• Teachers’ perceptions in students’ learning ability;
• Systematic support from the school leadership
Teacher Capacity Building Model

- Embodied Curriculum Design Experiences
- Mentor-Mentee Relationship both inter- and intra-school
- Meso-level agent supports in provision of PD and mediation between levels of actors
Conclusions

• The model of scaling with seeding effect is feasible for school(s) where an innovation has achieved success to take lead to spread a research-driven innovation.

• Multiple contextual factors intertwine to determine a successful diffusion of innovation in schools. Both top-down and bottom-up structure should be established for sustainable and scalable change in school contexts.

• Establishment of teacher learning community across schools and within school is critical for successful implementation, dissemination and evolution of an innovation.
Thank You!