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

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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:
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ICT in Ed Masterplan Journey

Masterplan 1

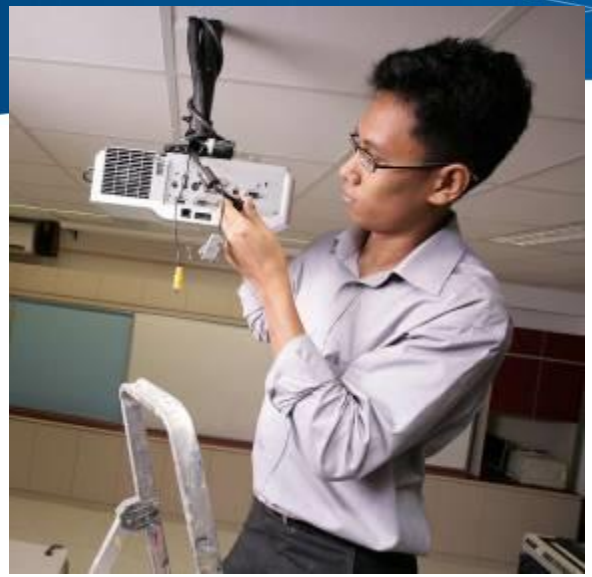
Building the Foundation

Masterplan 2

Seeding Innovation

Masterplan 3

Strengthening & Scaling



Core ICT Training for all teachers

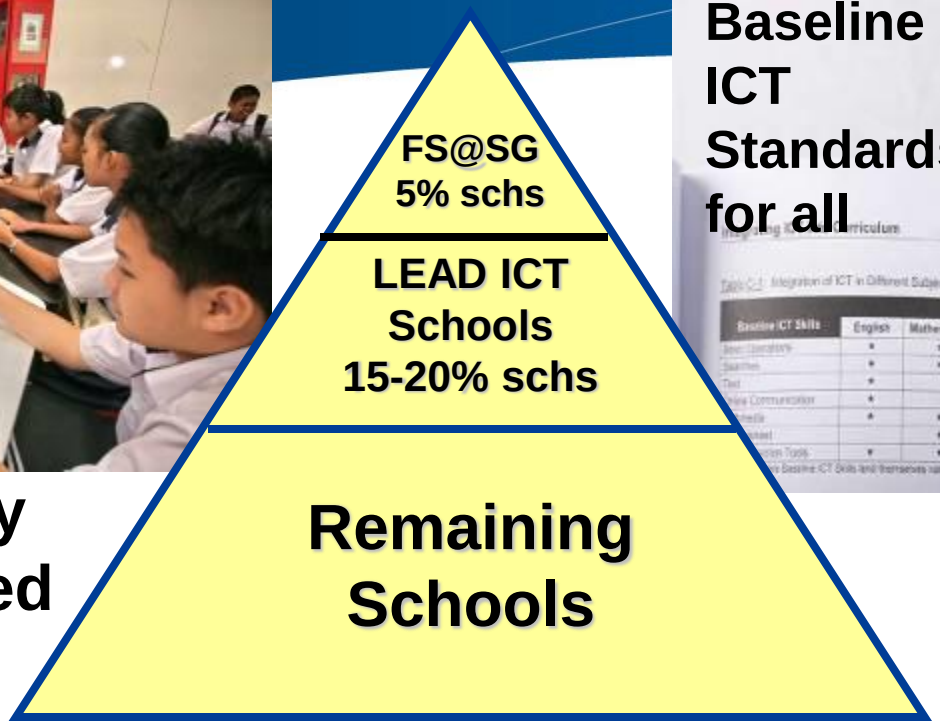
ICT Infrastructure & Support for all schools

Educational software & resources for relevant subjects

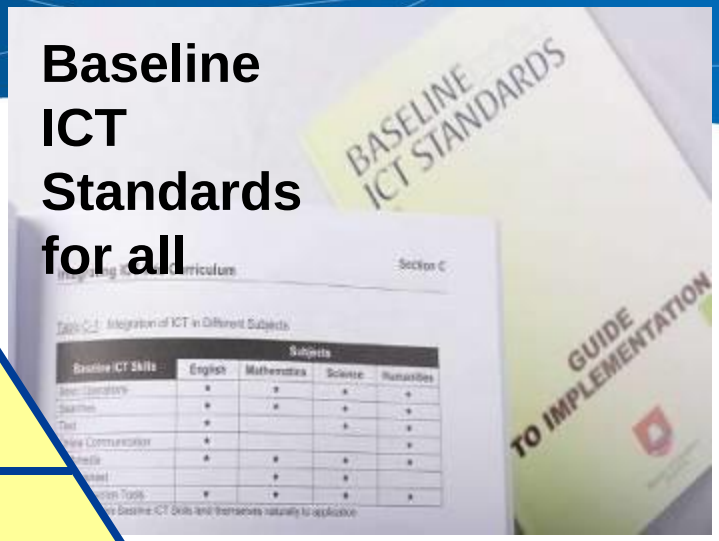
1997: Masterplan 1
Building the Foundation

ICT became an accepted tool for teaching & learning

Gave autonomy through devolved ICT funds



Baseline ICT Standards for all



Established Baseline ICT Standards for pupils

Generate innovative practices through schemes

2003: Masterplan 2
Seeding Innovation

Orientation of the Innovation – Intended Outcomes

'Curriculum 2015' Student Outcomes

Confident Person Thinks independently Communicates effectively Has good inter-personal skills	Self-directed Learner Takes responsibility for own learning Questions, reflects, perseveres Uses technology adeptly
Concerned Citizen Is informed about world and local affairs Empathises with and respects others Participates actively	Active Contributor Exercises initiative and takes risks Is adaptable, innovative, resilient Aims for high standards

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

	1st Masterplan Build Foundation	2nd Masterplan Seed Innovation	3rd Masterplan Strengthen & Scale
Curriculum, & Assessment	~ ICT supporting curriculum	~ ICT integrated into curriculum & assessment	~ ICT embedded into syllabuses & teaching guides
Professional Development	~ Core training for all teachers and school leaders	~ Differentiated Prof Development ~ Consultancy to school leaders	~ ICT Mentorship ~ Professional Learning Communities
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

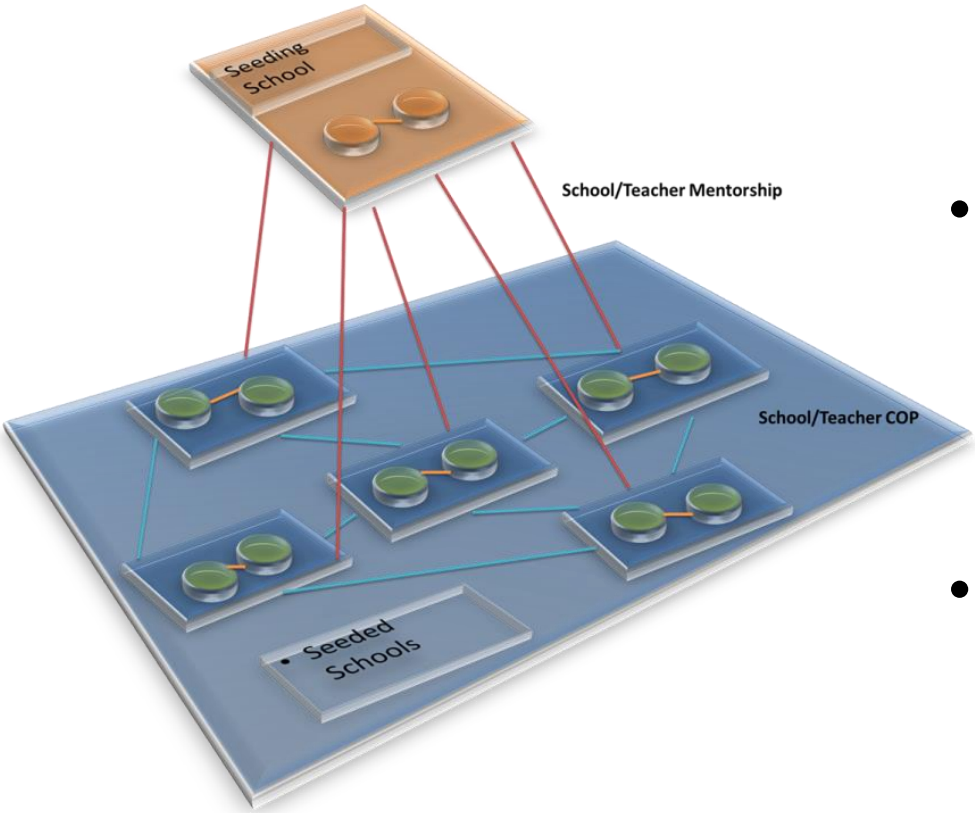
- Why is it (or not quite) ready for scaling? (When to scale?)
  - Design principles are ready
  - Increased teachers' awareness of the value of mobile learning principles
  - **More design of learning activities is needed**
  - **Don't quite have model of balancing needs for mobilized curricula & preparing 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

RE

Infusion	Dissemination	Evolution

2013	2014	2015	……

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

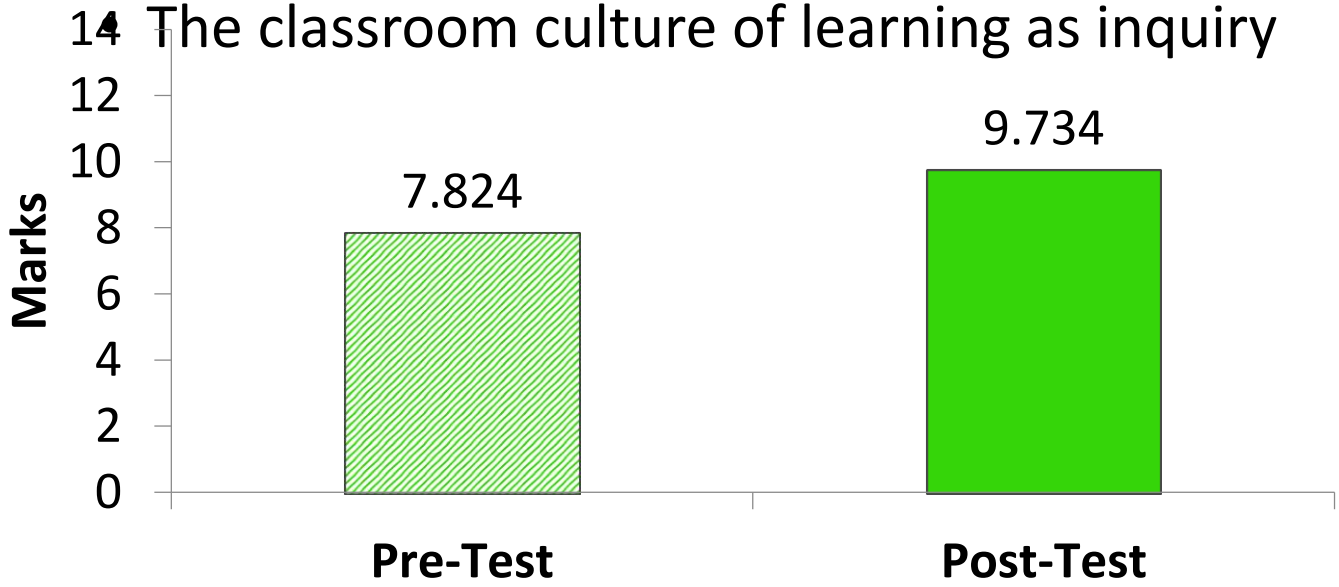
- Improve understanding of IBSL (especially the trialability, compatability, cost) through:
  - Lesson co-design for P3 topics
  - Lesson implementation with adaptation in pilot class in P3 in respective school
  - Post-observation conversations to reflect upon teaching practices
- Share the innovative 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



MCQ (4 questions)	5.33 / 8 m	5.66 / 8 m
OE (3 questions)	2.494 / 6 m	4.069 / 6 m

- **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

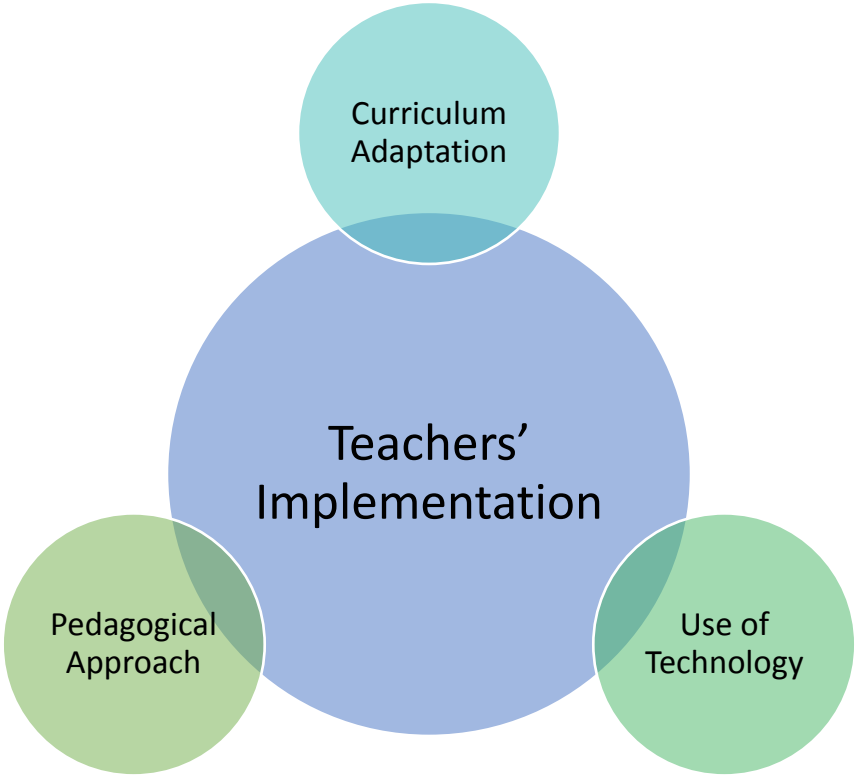
From teacher's pre- and post-survey

- **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

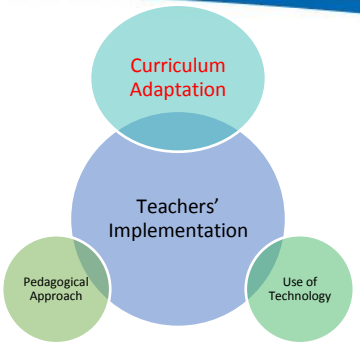
  - *Conditions of sustainable and scalable use*
    - My principal/Vice principal has to agree to extend the innovation to other cohort/classes
    - I am willing to use the innovative pedagogy as my routine teaching practice
    - My HOD ICT/Science has to agree to use IBSL for other cohorts/classes

From teachers surveys and interviews

- **Teachers' Implementation of IBSL**



- **Teachers' Adaptation of Curriculum**



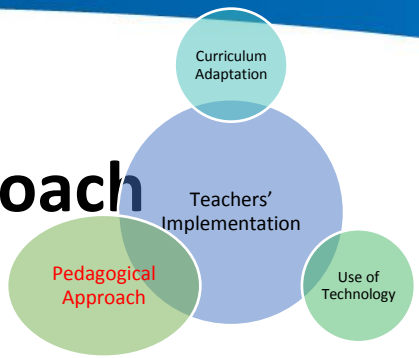
Evolution:
Take more ownership in curriculum development and evolve the curriculum package by integrating other available innovative resources available.

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.

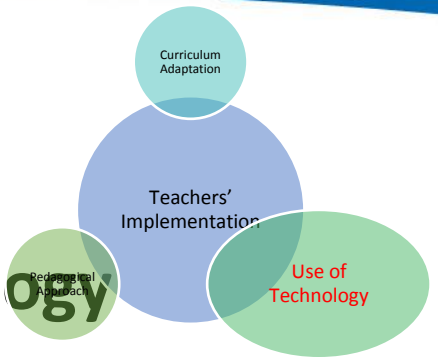
School A, B, D

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 C, E

- **Teachers' Differences in Use of Technology**



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

School D, E

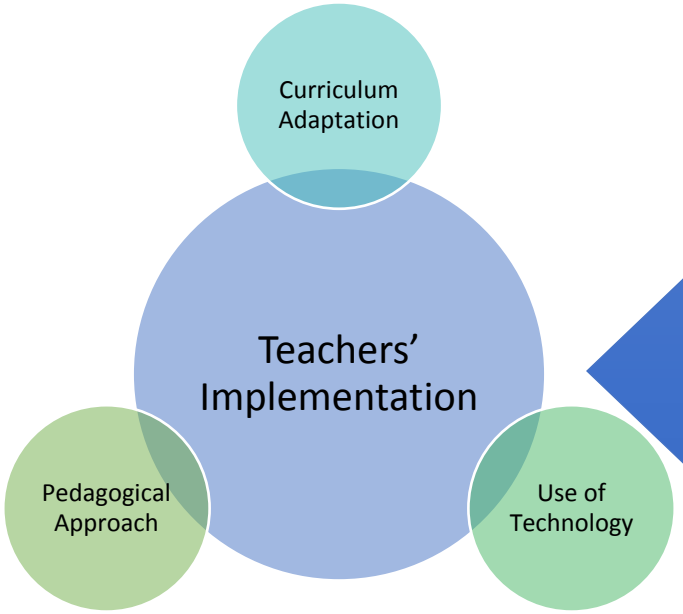
Explore use of different ICT –enabled strategies and tools
E.g. use of Edmodo and Socrative for formative assessment

School A, B

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

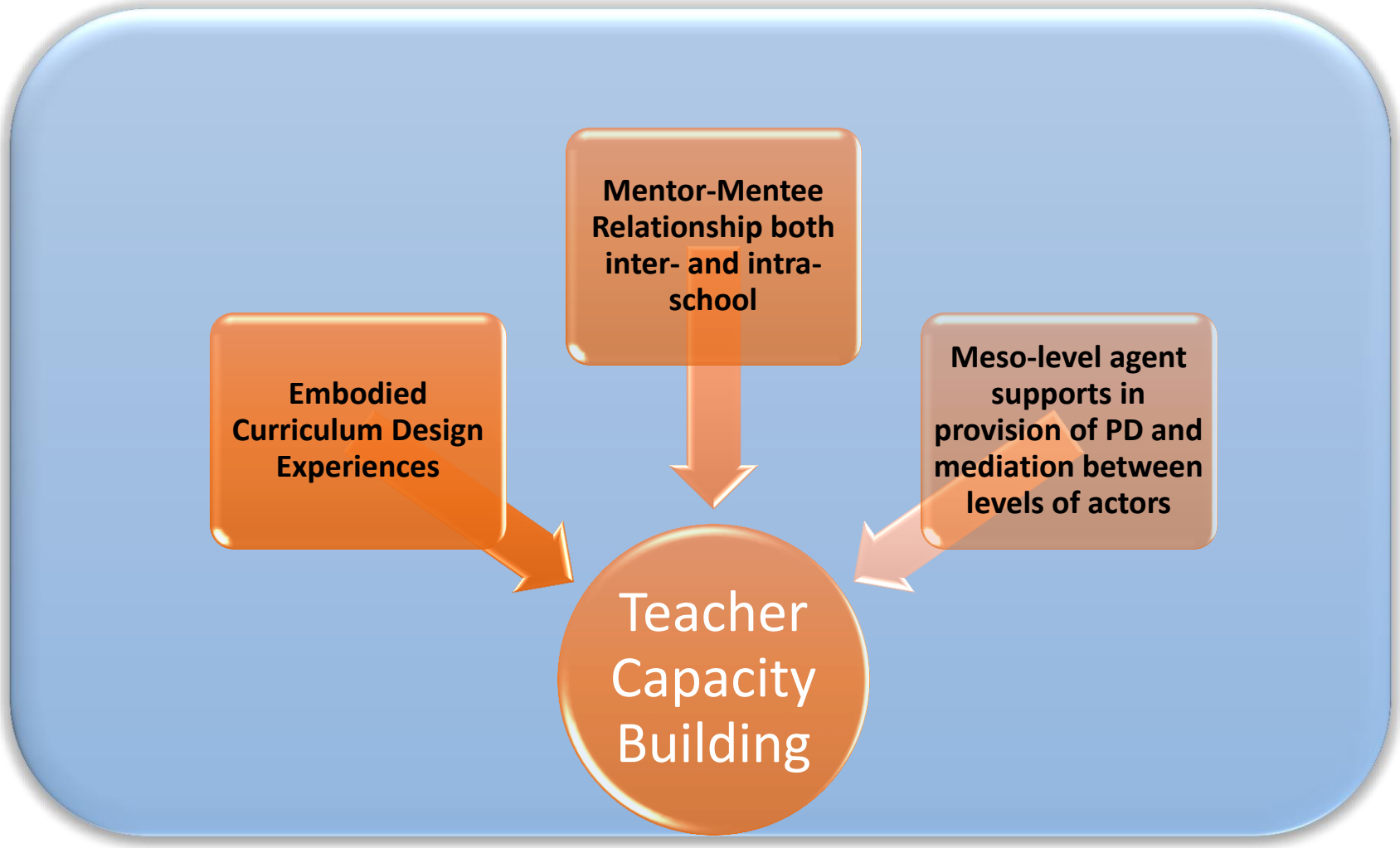
School C

School's status of use of technology



- 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



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!