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An Evaluation of Design and Enactment of Smartphone-enabled Primary Science Curriculum

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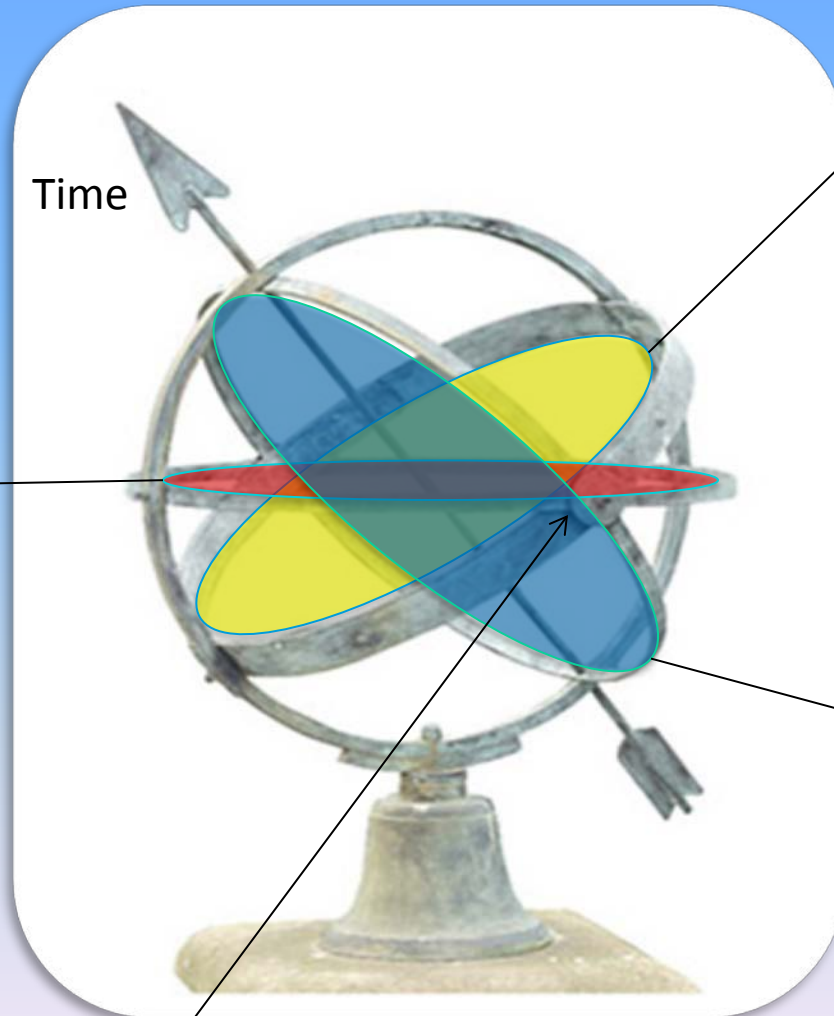
Our key ideas

- Seamless Learning
 - Linking formal & informal learning
- Transformative affordances of mobile technology
 - 24x7 access through 1:1 computing
 - Mobile device as a learning hub

Key messages

- A mobilized curriculum can make a difference to students'
 - Engagement
 - Self-directed learning
 - Collaborative learning
- Mobilizing the curriculum to harness mobile technologies in the classroom is a key challenge
- Mobile technologies mediate in-class and out-of-class learning
- Rich descriptions of informal learning in homes of students

What is Seamless Learning?



Personal Plane

SKA
Emotions
Preferences

Environmental Plane



School
Home
Others (e.g. designed spaces, informal spaces)

Social Plane

Community
Family
Friends

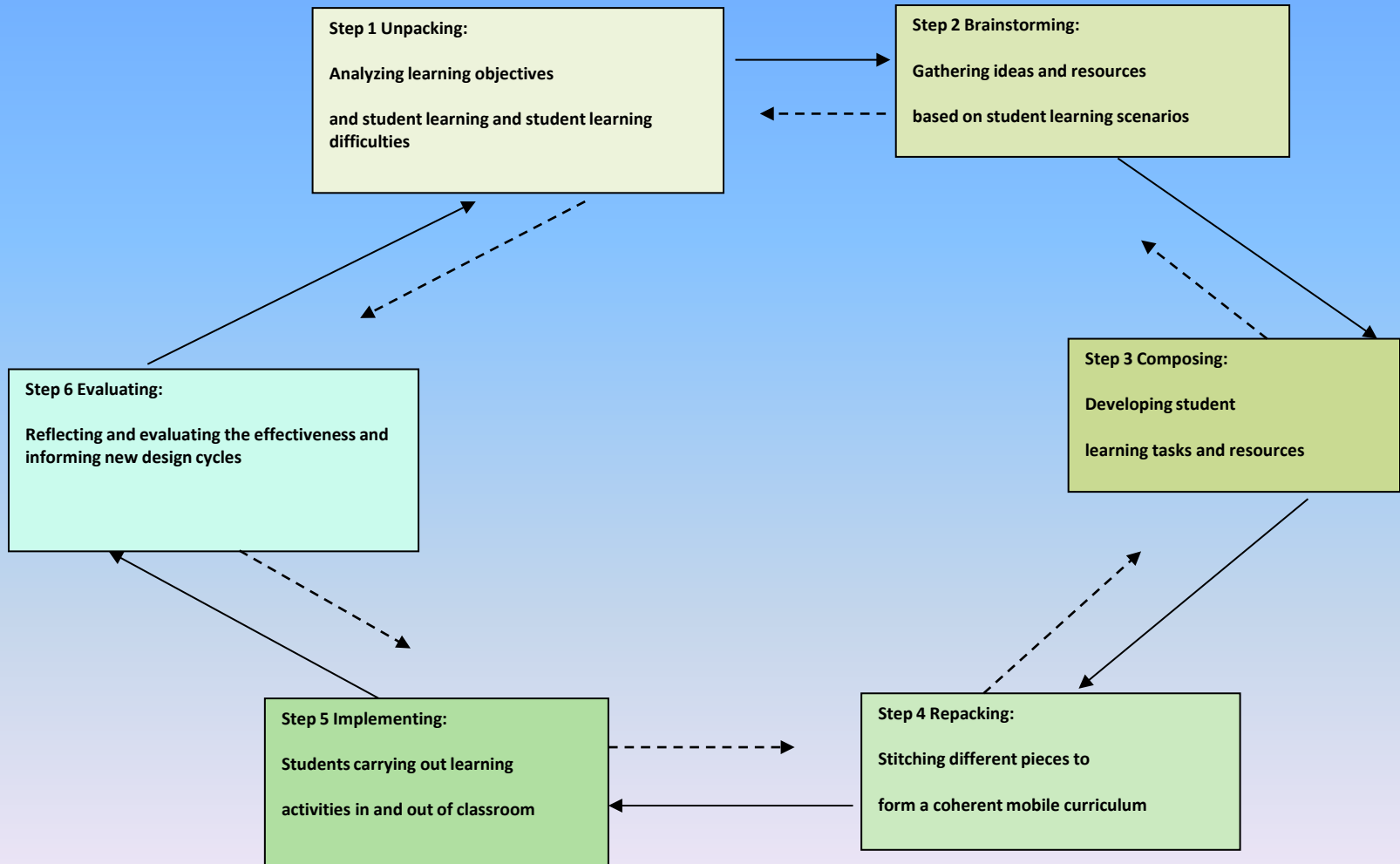
Nexus represent Technology

Formal and Informal Learning Spaces Mediated by Mobile Devices in 1:1 classroom

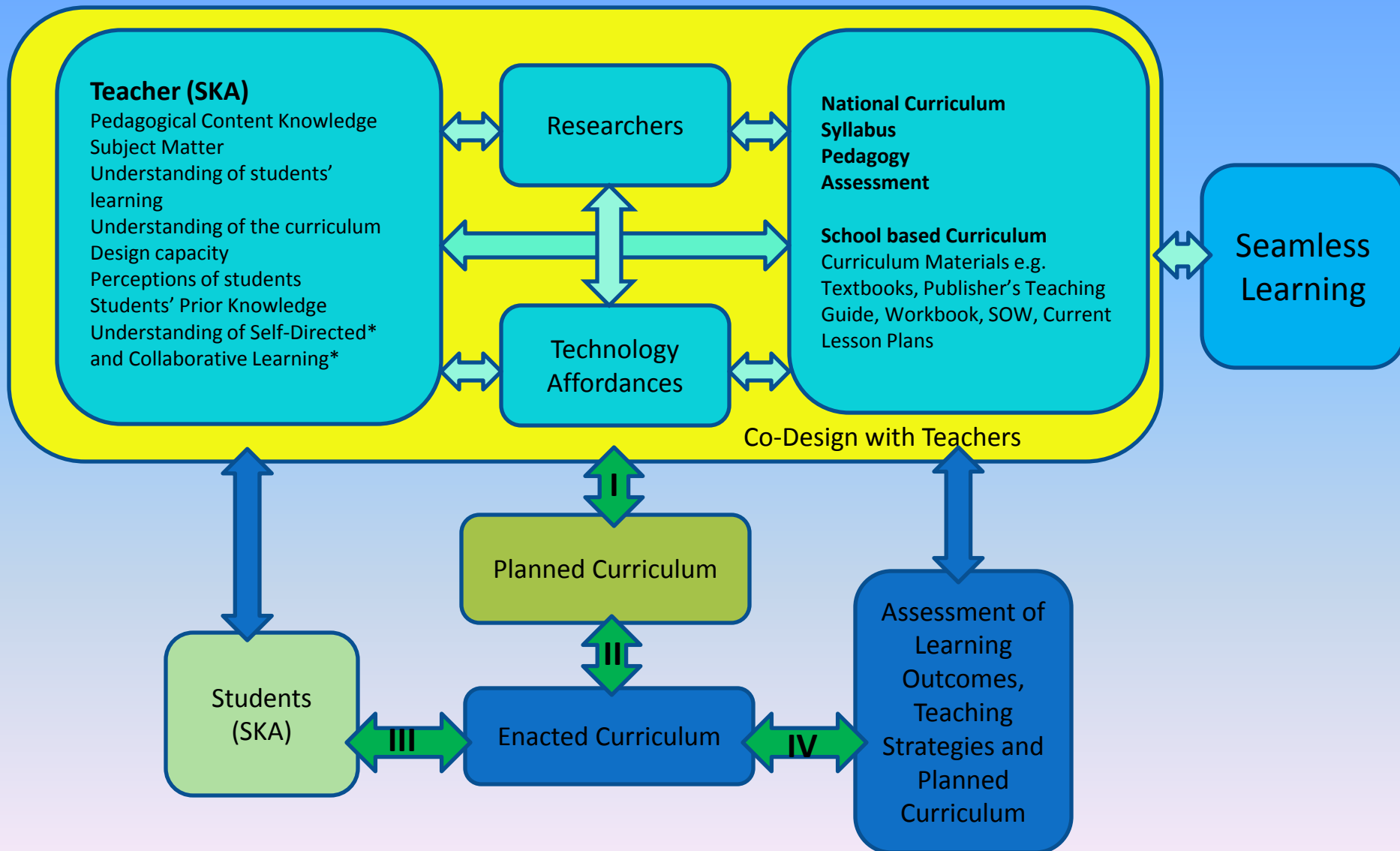
<p>Out Class</p>	<p>Type II Planned learning out of class e.g. field trip to an art museum which is part of a school curriculum</p>	<p>Type III Emergent learning out of class e.g. using mobile phones to capture pictures and video clips of animal and directed by self-interest</p> 
<p>In Class</p>	<p>Type I Planned learning in class e.g. searching for answers in the classroom</p>	<p>Type IV Emergent learning in class e.g. teachable moments not planned by the teachers</p> 
	<p>Planned</p>	<p>Emergent</p>

TYPE I and TYPE II
Planned

Lesson Design Framework for MLE



Process Framework for Curriculum and PD



Rationale for studying emergent learning

- 1) To study integrated and synergistic effects of learning in both formal and informal settings for continuity of learning experiences across different scenarios.
- 2) To acquire sophisticated understanding of students' social, intellectual and cultural capital.

ROBERTS (2005) & SEFTON-GREEN (2004):

Informal learning can be explored by looking at the four dimensions:

- Location
- Purpose
- Process
- Content



Characteristics of Seamless Learning

Learning	Technology Usage
Participatory Learning (Rogoff)	Pictures, Video,
Collaborative Learning	Sharing artefacts, Blogs,
Authentic Learning	Pictures, Video,
Knowledge Construction	Searching, Comparison,
Learning across timescales (Lemke)	Connecting, Collect Artefacts, Hub

Research Design – Lesson Design

- their parts, you will be required to:
1. Identify and explain what is a system
 2. Identify and state the functions of different parts of plants e.g. leaf, stem, root.
 3. Compare different parts of plants e.g. leaf, stem, root according to shapes, sizes, colour and texture. State and label the transport system of the stem.



Goals of Lesson

Experiment (video)

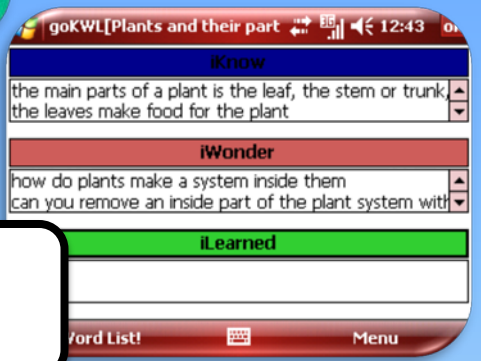
PiCo Map

KWL

Sketchy

Comparison Table

Picture Taking



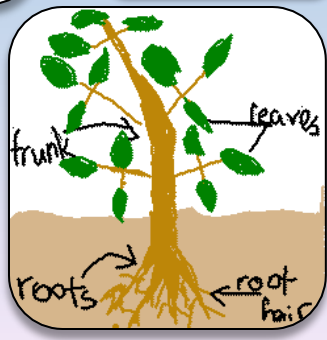
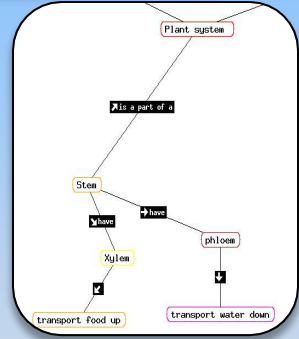
MLE Lesson Package For learning Plant Systems

Word Mobile

Activity 3 – Functions of plant parts

Parts of plant	Functions
Roots	Help the plant to hold firmly on the ground.
Root Hair	Help plant to absorb water and mineral.
Stems	Help plant to transport water and minerals.

View Menu



SA1/SA2 Results in Science

- Background
- Overall Performance Gains
- HA-MA-LA Effect
- Teacher Effect
- Summary of SA1/SA2 Results on Science

Background

- There are totally 299 students in eight classes (3A, 3B, 3C, 3D, 3E, 3F, 3G and 3H) at the P3 level in NCPS that have participated in the intervention of smartphone science curriculum in 2012. The eight classes are divided by teachers into three levels of ability, named as HA-MA-LA, according to their prior performances.

HA-MA-LA Classes

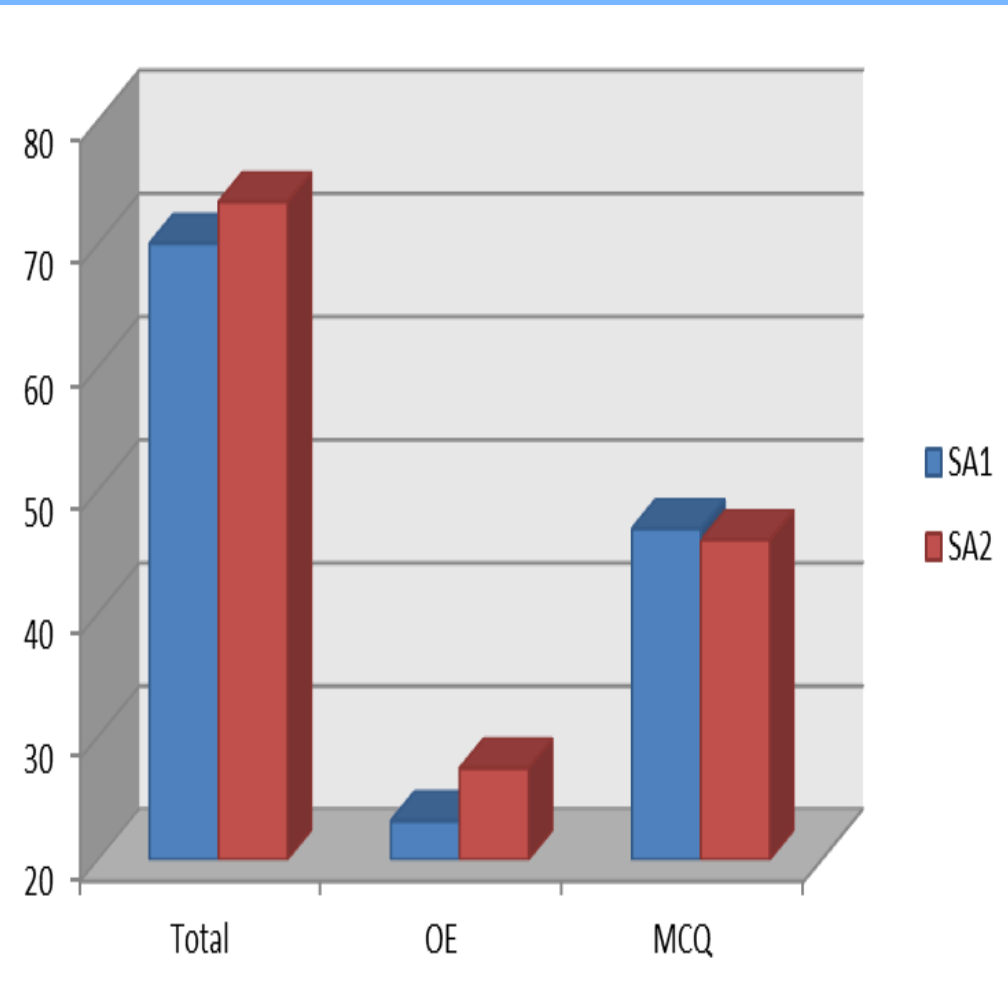
Level	Class	Teacher
HA (High Ability)	3A (44 students)	T1
	3B (43 students)	T2
	3C (42 students)	T3
MA (Mixed Ability)	3E (41 students)	T4
	3F (40 students)	T5
	3H (39 students)	T3
LA (Low Ability):	3D (25 students)	T2
	3G (27 students)	T6

- The scores for the SA1/SA2 tests in Science are divided into three parts: Total Scores, MCQ (Multi-Choice Questions) Scores and OE (Open-Ended Questions) Scores.

Components of SA1/SA2 Scores

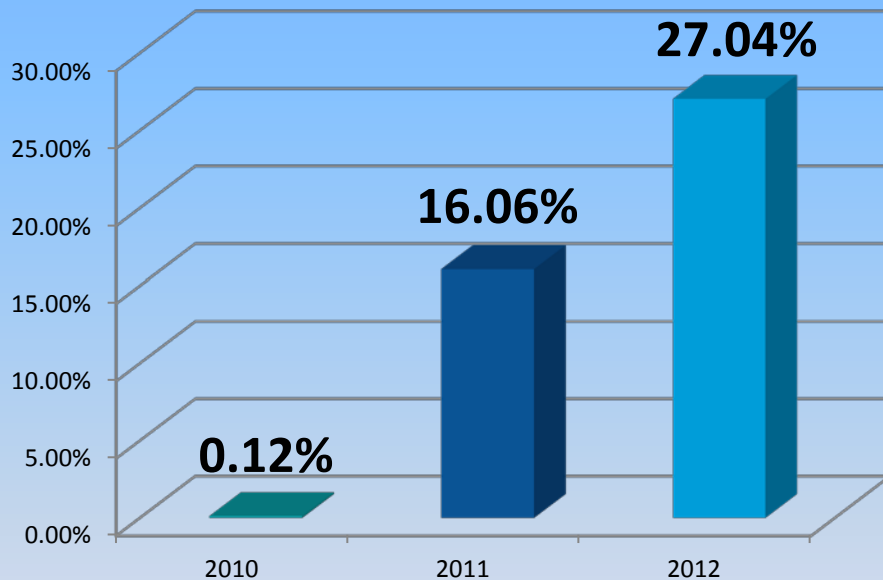
Scores	SA1	SA2	Gain
Total Scores	SA1_Total	SA2_Total	SA_Gain
MCQ (Multi-Choice Questions) Scores	SA1_MCQ	SA2_MCQ	MCQ_Gain
OE (Open-Ended Questions) Scores	SA1_OE	SA2_OE	OE_Gain

Overall Performance Gains



In Science classes, children using smartphone-enabled curriculum showed significant **7.69%** improvement in their total scores, more specially, **27.04%** ability improvement to answer open-ended questions.

**Rate of Growth at P3 Level
in answering Open-Ended Questions
of Science**

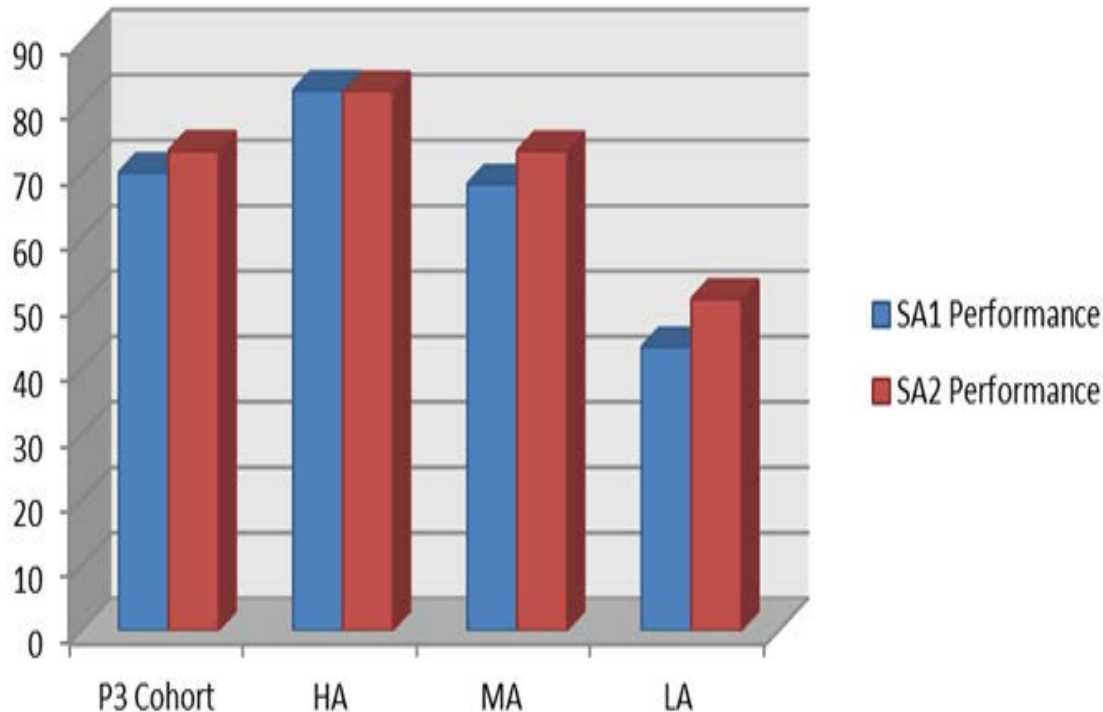


In recent three years, Year 2012 is the first one to experience the most prominent progress in SA1/SA2 OE (Open-Ended Questions) scores leading to a remarkable growth in total scores for the recent three years at the P3 level.

Implications

- When Science OE improves, other than a possible improvement in content knowledge, we may be able to interpret it as a sign of process skills like communication, synthesis of ideas etc. Once the children possess the right skills, they will be able use them across contexts.

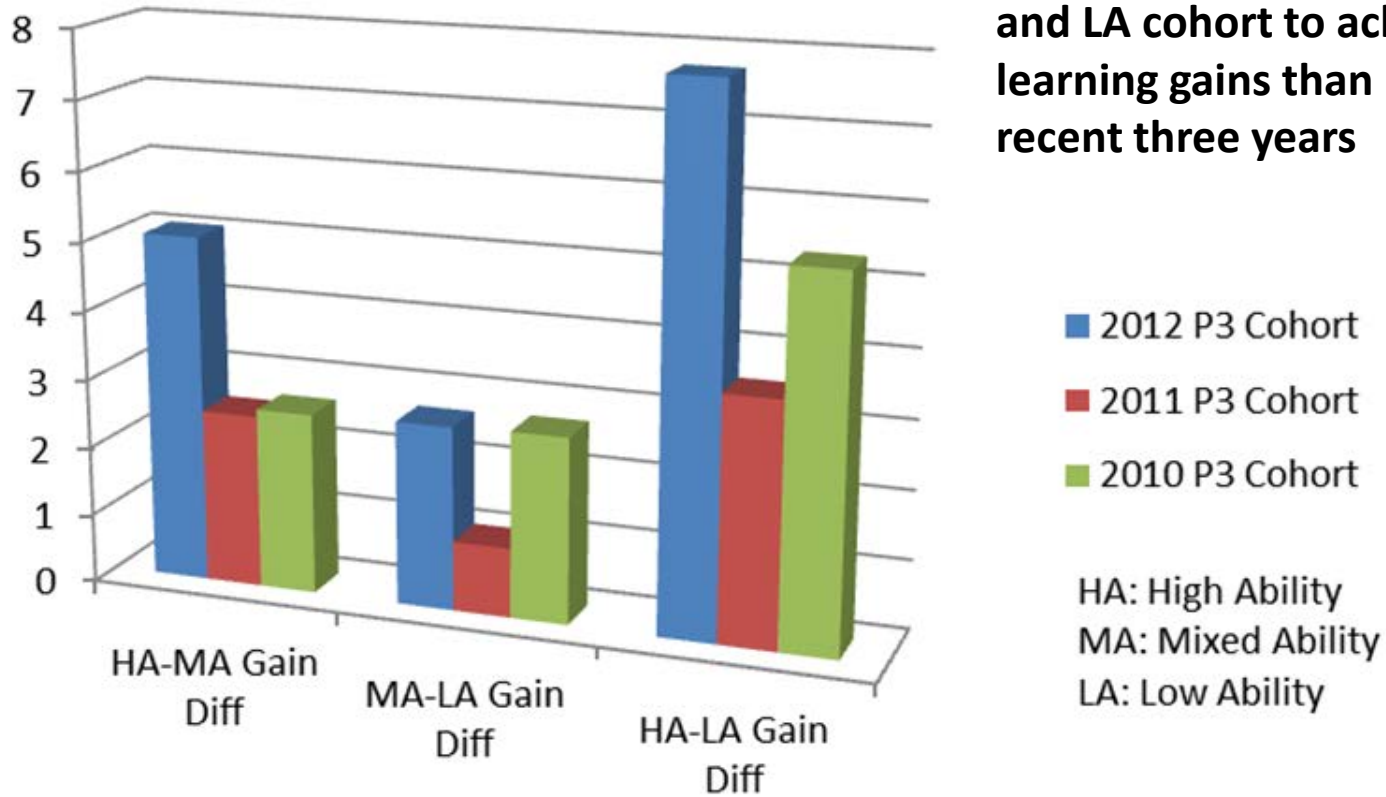
HA-MA-LA Effect



The analysis shows that MA and LA students have achieved more learning gains as comparing to the HA students.

- As to SA_Gain, there is significant difference between HA and MA (*Mean Difference = 5.12, $p < .05$*) and between HA and LA (*Mean Difference = 7.47, $p < .05$*).
- As to MCQ_Gain, there is significant difference between HA and MA (*Mean Difference = 2.81, $p < .05$*) and between HA and LA (*Mean Difference = 4.86, $p < .05$*).
- As to OE_Gain, there is significant difference between HA and MA (*Mean Difference = 2.33, $p < .05$*) and between HA and LA (*Mean Difference = 2.61, $p < .05$*).

Year 2012 is the first year for MA and LA cohort to achieve more learning gains than HA cohort in recent three years



HA group in 2012 shows **11.7%** increase in answering open ended questions

MA group in 2012 shows **8.6%** increase in total scores, **29.6%** increase in answering open ended questions

LA group in 2012 shows **20%** increase in total scores, **60.3%** increase in answering open ended questions, **10.4%** increase in answering MCQ questions.

Teacher Effect

The t- test Result of Total, OE and MCQ Gains for Class 3B and 3D under T2 in Year 2012

	F	Sig.
SA_Gain	8.399*	.005
MCQ_Gain	7.329*	.009
OE_Gain	.002	.967

A t-test shows that class 3D (LA) makes more progress in SA_Gain ($F = 8.399, p < .05$) and MCQ_Gain ($F = 7.329, p < .05$) than 3B (HA). It is consistent with the HA-MA-LA effect at discussed before.

The t- test Result of Total, OE and MCQ Gains for Class 3C and 3H under T3 in Year 2012

	F	Sig.
SA_Gain	4.313*	.041
MCQ_Gain	3.397	.058
OE_Gain	.033	.856

A t-test shows that class 3H (MA) makes more progress in SA_Gain ($F = 4.313, p < .05$) than 3C (HA). It is also consistent with the HA-MA-LA effect at discussed before.

Teacher effect is not obvious in 2012 SA1/SA2 learning gains.

Summary of SA1/SA2 Results on Science

Overall the results are very encouraging so far.

1. The SA1/SA2 gain in total scores is significant in 2012 for the whole P3 cohort.
2. MA/LA cohort has more SA1/SA2 gain comparing to HA cohort, which is the first time in recent three years at the P3 level.
3. The SA1/SA2 gain is mostly due to the improvement in Open Ended questions as there is no significant improvement in MCQ scores, which is the first time in recent three years at the P3 level.
4. For teachers teaching two classes:
 1. The gain in the SA and MCQ for 3D was higher than 3B, which is consistent to the HA-MA-LA effect.
 2. The gain in the SA for 3H was higher than 3C, which is also consistent to the HA-MA-LA effect.

Summary

- Overall, Nan Chiau Primary School has provided more than 350 students, teachers and school staff with 3G mobile internet access to complement the school's pedagogy and curriculum
- During the project's pilot phase, students using smartphones for learning became more independent, inquisitive and self-directed
- Overall, test scores have improved significantly:
 - In Science classes, children using smartphones showed significant improvement in their ability to answer open-ended questions

Summary

- Teachers are adapting their teaching methods to incorporate technology and reflect the positive results and response from students
- Parents have become more open to using technology for learning and support new learning tools such as text, drawings, and audio and visual recordings
- Partners will expand the project to include 300 new students in the P4 level at Nan Chiau Primary School in 2013