CONFERENCE FOR MATHEMATICS TEACHERS

Singapore Mathematical Society

Conference 2014

Theme: Assessment in Mathematics

Designing Formative Assessments in Mathematics Lessons

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Overview of P6 Workshop

Part I

- The 3 'Ps' of Assessment
- Assessment – purpose, forms & modes
- Interpretations of Assessment Results

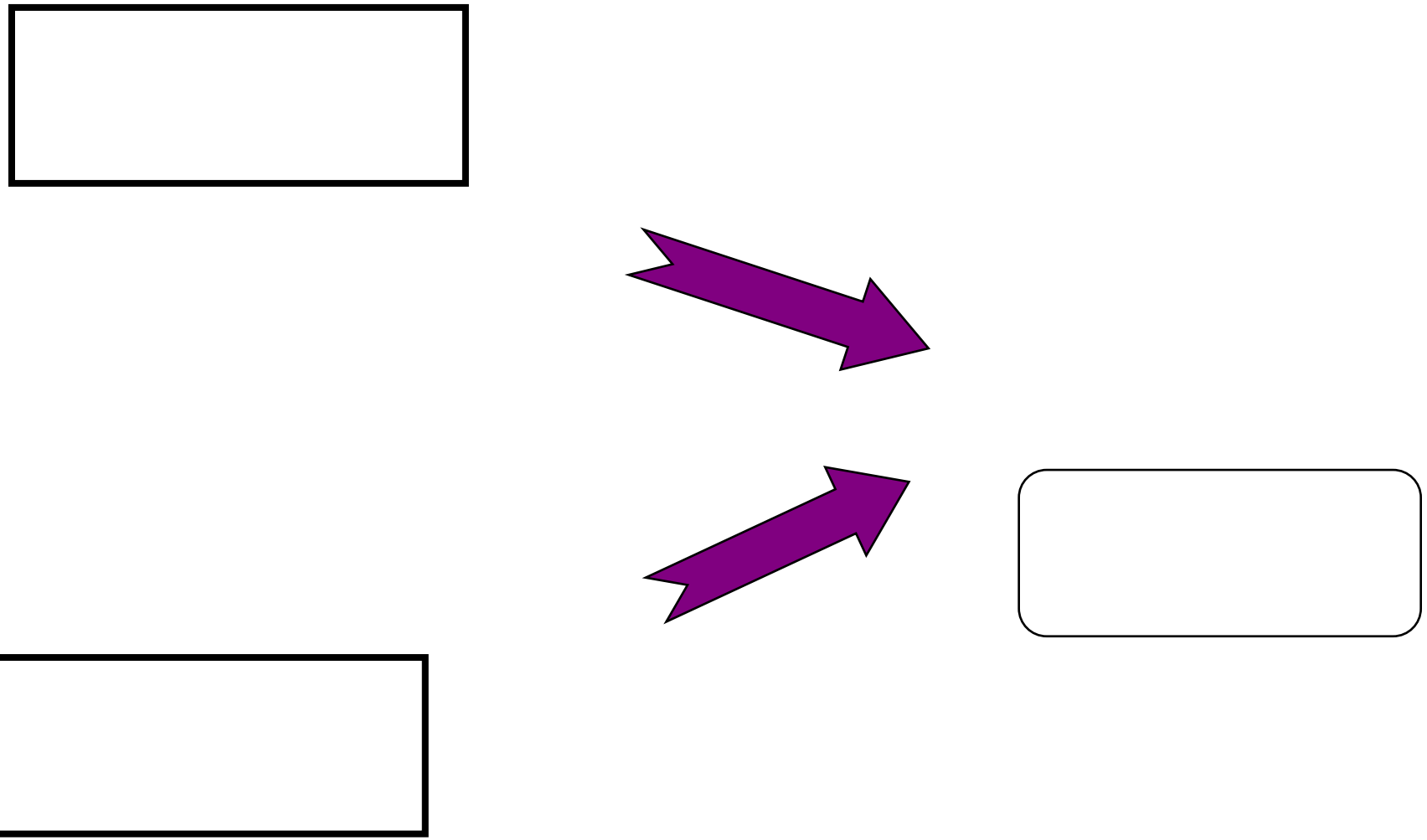
Part II

- Linking Formative Assessment with ICAN Project
- Crafting Assessment Items

– Questioning & Communication process

– Items for Consolidation or Review

The three Ps of Assessment



P_____: Primary Education

** 4-year foundation stage from P1 to P4*

**2-year orientation stage from P5 to P6.*

The overall aim is to give students a good grasp of English language, Mother Tongue and **Mathematics*

- **Literacy and Numeracy**
- *'Streaming'* - orientation stage*
- **NE**
- **Critical and Creative Thinking**
- **ICT in Education**
- **TLLM**

P_____

- _____ and _____learning & teaching processes
- *fit* the its intended purpose (_____)
- *align* to the range of instructional goals and outcomes
- strike a _____between formative & summative assessments

P

- have multiple forms and modes of assessment
- be practical and manageable in implementation
- be free of biases
- be transparent

P

School-Based Assessments: [P1, P2]

P3 to P5

Continual Assessment (CA): 30% ***(a guide)***

15% (T1) 15% (T3)

Semestral Assessment (SA): 70% ***(a guide)***

25% (T2) 45% (T4)

P

National Examination:
Primary School Leaving Examination (PSLE)

National Placement Examination to assess pupils' suitability for secondary education

Definitions of Assessment

Assessment is an integral part of education.

It includes ‘_____’ which describe the

- extent of learning
- degree of correspondence with the aims and objectives of teaching
- relationship with the environments designed to facilitate learning’

(Satterly, 1989)

Purpose of Assessment

- indicate the degree to which pupils have achieved the learning targets.

For Diagnostic/Formative Purpose

- identify learning weaknesses
- administer at the beginning or after an extended period of instruction

Purpose of Assessment

For placement or Selection Purpose

- determine _____ for

- the *next level of education* and

-*placement* to an appropriate stream or course

- provide clearly defined assessment criteria and standards of achievement

Purposes of Assessment…to improve

Learning	Teaching
Making _____ visible to students	_____instruction
Fostering reflective learning &_____	Fostering reflective teaching to_____

Stefanakis, E. H. (2011) p11

Modes of Assessment

What is Formative Assessment (CA)?

- is *conducted* during the *teaching-learning process*
- usually *tests a particular section* of a unit /course of instruction; should be *criterion-referenced*
- conducted through *observation, classroom questioning & quizzes, short class tests & homework*

Why use it?

Modes of Assessment

What is Summative Assessment (SA)?

- is conducted at the end of the course of instruction
- should be based on a broad coverage of the scheme of work for the whole year

Why use it?

Modes of Assessment

*A: Paper-and-Pencil test***

- The main item types are:
- selected response items: Matching
  True-false
  MCQ
- constructed response items:
  Short-answer question
  Structured question
  Long-answer question

Modes of Assessment

B: Other Types of Assessment

- Mathematical Investigation/Mathematical modelling
- Journal Writing
- Classroom Observation
- Conferencing
- Self-Assessment
- Portfolio Assessment

Interpretation of Assessment Results

- Objective(s)

- Consequences

Reliability & Validity

Assessment should give

_____ **information**

about a learner's knowledge and ability

The assessment should be _____

A good test/assessment should always strive to achieve _____

Reliability

_____ of Assessment **Results** over

_____

- **Check for reliability:**
- Consistent Marking
- Agreement among markers
- Same rank order in a parallel test
- Sufficient time for completion

Validity******

Degree to which Assessment Information

Check for validity:

- Measure important & relevant component(s)
- Measure the intended variable(s)
- Provide required information about pupils
- Assessor's consideration on the consequences of interpreted information

Designing a Test Item …OMR

What

Is the Learning Objective?

Is it **Measuring?**

Should the **Results show?**

Competency	Skills Demonstrated/ Question Cues
Knowledge	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, etc
Comprehension	Summarise, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend, etc
Application	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover, etc

Benjamin S. Bloom Taxonomy of Education Objectives

Part II:

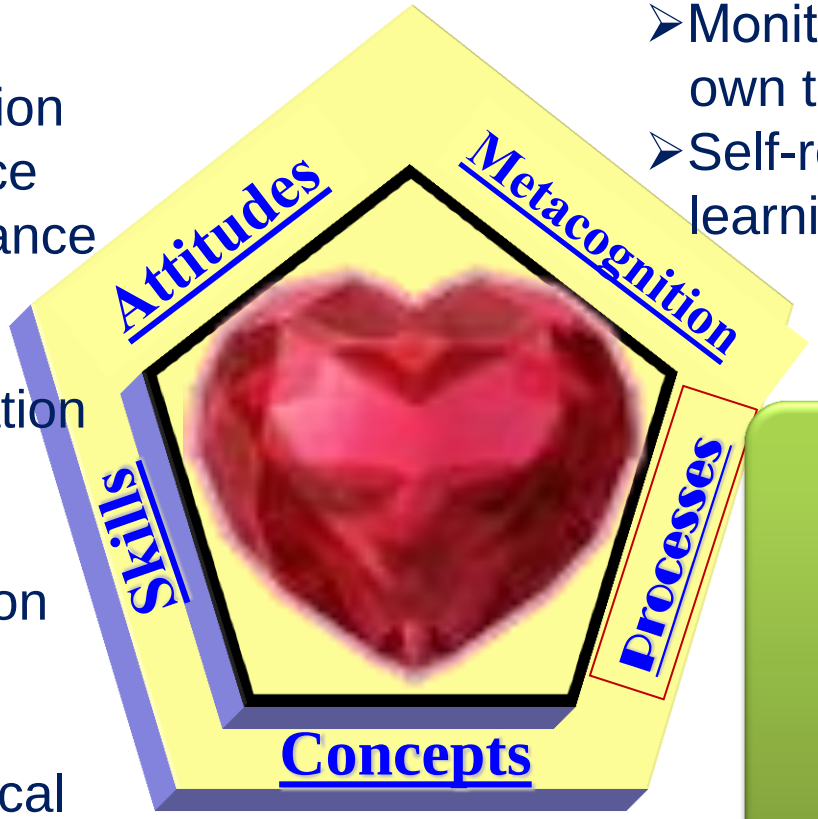
Choice of assement Strategies must be guided by its purpose!

Crafting Assessments items In Mathematics Lessons

Singapore Mathematics Framework

- Beliefs
- Interest
- Appreciation
- Confidence
- Perseverance

- Monitoring of one's own thinking
- Self-regulation of learning



- Numerical calculation
- Algebraic manipulation
- Spatial visualisation
- Data analysis
- Measurement
- Use of mathematical tools
- Estimation

- Numerical , Algebraic
- Geometrical, Statistical
- Probabilistic, Analytical

Mathematical Processes

Syllabus Organisation [2013]

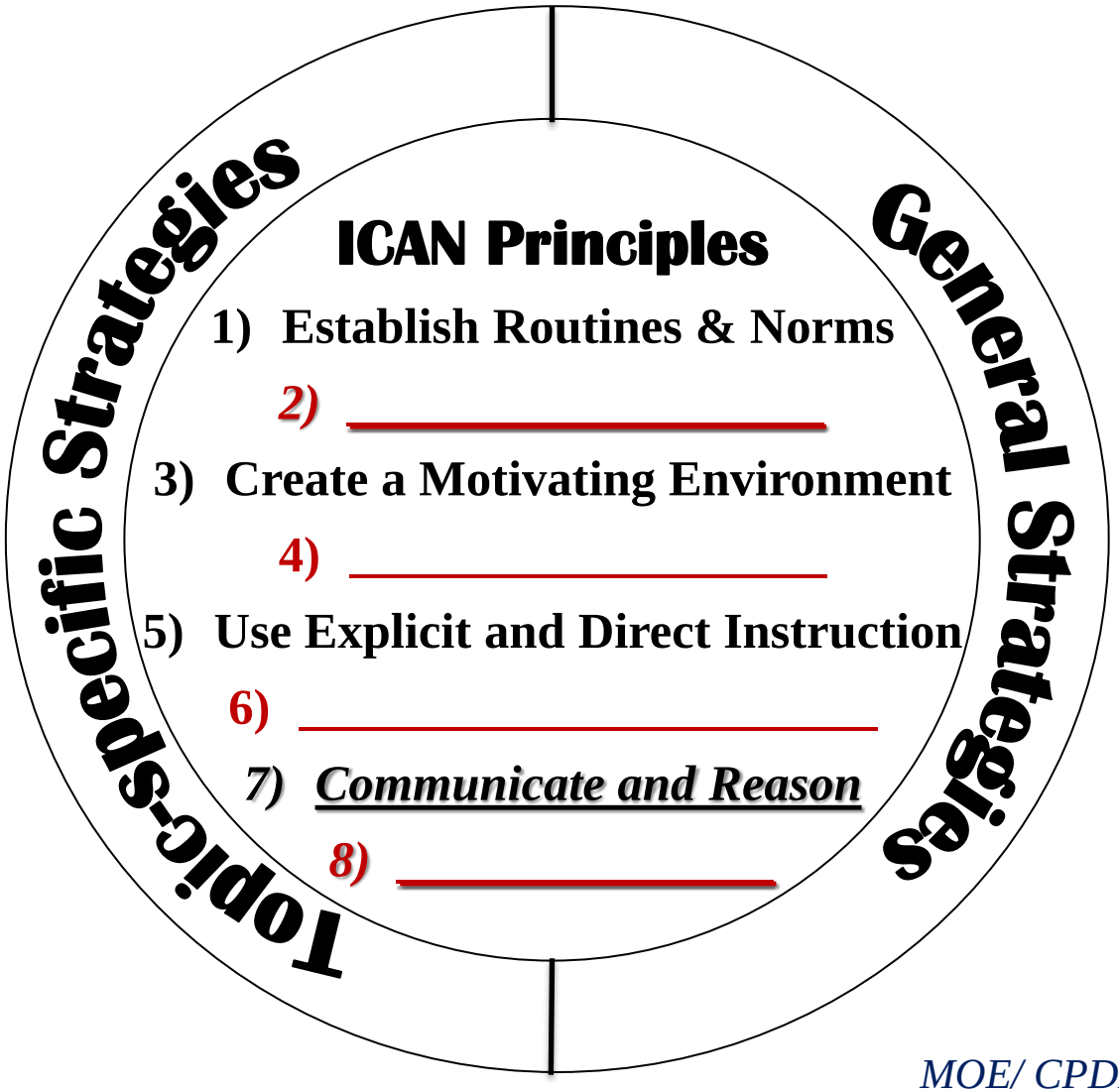
3 content strands + 1 Process Strand

Number and Algebra	Measurement and Geometry	Statistics

Mathematical Processes

CPDD_Primary Mathematics Teaching and Learning Syllabus (2012)

ICAN [Improving Confidence and Achievement in Nurmeracy] Project



L_____
G_____
_

- L_____
  M_____
- M_____

Notions of Mathematical Proficiency

-conceptual understanding
-procedural fluency
-strategic competence
-_____
-productive disposition

"_____" is the glue that holds everything together

_____

- allows for concepts and procedures to _____in sensible ways
- suggests possibilities for problem solving and
- allows for disagreements to be settled in reasoned ways

Kilpatrick, et al. (2001)

What is formative Assessment?

- (P*opham, 2006; Shepard, 2008)*

- ***five*** elements should be in place: the
  - effective feedback
  - active involvement
  - adjustment of teaching
  - profound influence assessment
  - students self -assess

Learning Experiences (LE)

- Enhance *conceptual understanding* through use of the CPA approach & various mathematical tools including ICT tools'
- Apply concepts and skills learnt in real-world context
- _____their _____through mathematical *tasks* and *activities*
- Build confidence and foster interest in mathematics

CPDD_Primary Mathematics Teaching and Learning Syllabus (2013)

Why do we need to teach mathematical vocabulary?

"Words communicate content. If learners are unfamiliar with the vocabulary particular to a content area, they will struggle to grasp that content"

Santa, Havens, and Valdes, 2004

Samples of Mathematics Items or Questions

Questions / Items that Foster …

- Communications using the appropriate mathematical language/terms
- Learners' thought process

P4: Multiples

Question Shells:

Original	Reframed
Is 8 a multiple?	

Question with Contrast:

Original	Reframed
What is a multiple?	

P5: Geometrical Figures

What vocabulary is needed to give the correct response?

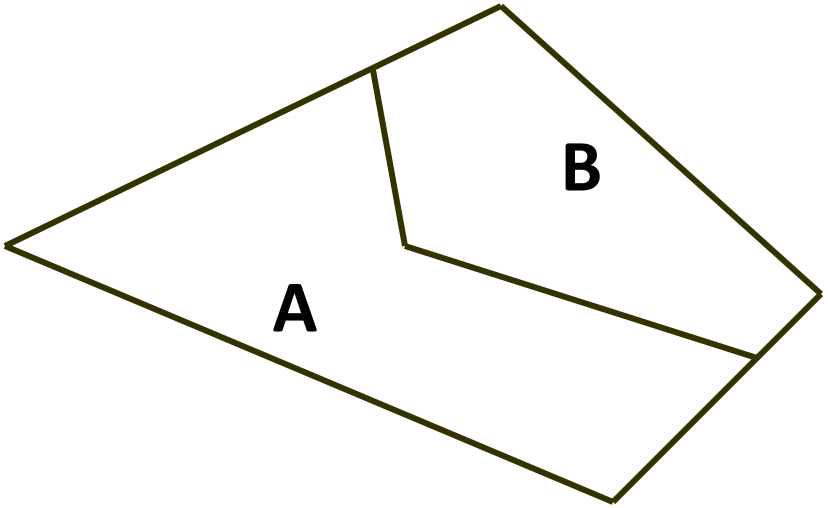
Question Shells:

Original	Reframed
Is a square a trapezium?	

Question with Contrast:

Original	Reframed
Does a square have 4 equal angles?	

P6: Mensuration



Original	Reframed
Given that the ratio of A:B is 3:2 and the total area is 20 km^2 Find the area of each plot land.	

1 Useful Strategy: use open questions

- Allows different learners to approach it by using _____or strategies

- but also in allowing for learners at different stages of mathematical development to _____ to the task.

=>

P4: Fractions & Decimals

Open Question:

Textbook Q	Reframed Q
1) What is a quarter of 40?	
2) The diameter of a discs is 2.75 cm. Express the diameter as a fraction in its simplest form.	

P5: Angles from pattern blocks

Open Question:

Textbook Q	Reframed Q
1) Choose a shape. Measure the angles of each shape.	

P6: Average

Open Question:

Textbook Q	Reframed Q
1) Find the average of 7, 8 and 9?	
2) If the average of 2 numbers is 4.5, one number is 8, what is the other number?	