Pedagogies for thinking and creativity: The Singapore Context

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Our Journey in Thinking

- 1987: Cognitive Research Trust (CoRT) Thinking Programme
- 1994: Dimensions of Learning Framework
- 2000: Revised subject syllabuses and textbooks incorporate thinking skills
- 2000: Project work introduced – creative and critical thinking skills
The 21st Century Competencies (21CC) Framework

- Core Values
  - Responsible Decision-Making
  - Social Awareness
  - Relationship Management
  - Information and Communication Skills
- Critical and Inventive Thinking
- Concerned Citizen
- Confident Person
- Civic Literacy, Global Awareness and Cross-cultural Skills
- Self-directed Learner
Role of ICT in Developing Innovation Skills

• MOE Masterplans for the use of Information and Communication Technology (ICT) in education (since 1997)
• create the conditions in schools to harness ICT for the development of Self—Directed Learning (SDL) and Collaborative Learning (CoL)

• SDL and CoL are skills and learning processes integral to achieving 21CC

• ICT an effective platform through which to develop 21CC

• ICT now feature commonly in teachers’ pedagogy
Approach to the Adoption of Pedagogies

• Various subjects adopt different strategies to deepen the learning of respective disciplines.

• For example:
  – Problem Solving Focus: Mathematics
  – Inquiry-Based Learning (IBL): Sciences and Humanities
Problem Solving in Mathematics

Inquiry-Based Learning (IBL) in the Sciences & Humanities
Mathematics Curriculum Framework

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

Beliefs
- Interest
- Appreciation
- Confidence
- Perseverance

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

Reasoning, communication and connections
- Applications and modelling
- Thinking skills and heuristics

Skills
- Concepts
- Processes
- Metacognition
- Attitudes

Numerical, Algebraic, Geometric, Statistical, Probabilistic, Analytical

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<table>
<thead>
<tr>
<th>Elements of Critical and Inventive Thinking</th>
<th>Mathematical Processes</th>
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<tbody>
<tr>
<td>Reasoning, Communication, Connections</td>
<td>Applications and Modelling</td>
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<tr>
<td>Sound Reasoning and Decision-Making</td>
<td>Analyse math situations, construct logical arguments make connections</td>
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<tr>
<td>Reflective Thinking</td>
<td>Reflect on solutions to real-world problem, consider alternatives</td>
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<tr>
<td>Curiosity and Creativity</td>
<td>Solve unfamiliar real world problems</td>
</tr>
<tr>
<td>Managing Complexities and Ambiguities</td>
<td>Tackle variety of problems; deal with ambiguity; make assumptions</td>
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Problem Solving in Mathematics

Inquiry-Based Learning (IBL) in the Sciences & Humanities
Science Curriculum Framework in Singapore
Engaging with an event, phenomenon or problem through:

-Formulating hypothesis
-Generating possibilities
-Predicting

Collecting and presenting evidence through:

-Observing
-Using apparatus and equipment

Reasoning; Making meaning of information and evidence through:

-Comparing
-Classifying
-Inferring
-Analysing
-Evaluating

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Communicating

Processes

Creative problem-solving, Investigation and Decision-making

Essential Features of Inquiry

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<tr>
<th>Question</th>
<th>Evidence</th>
<th>Explain Connect</th>
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<td>Communication</td>
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A Framework of the Humanities Inquiry Approach
Alignment to Critical and Inventive Thinking

The Inquiry Process

- Sparking Curiosity
- Gathering Data
- Reflective Thinking
- Exercising Reasoning
Support for School Implementation
Professional Learning of Teachers

- Conduct of workshops on learning experiences
- School visits to support classroom teaching and learning
- Curriculum officers- teachers collaborations
Mathematics: Concrete-Pictorial-Abstract

Meaningful contexts
Use of manipulatives
Use of pictorial representations
Connecting the different representations
Example: The ratio of Susan’s money to Mary’s money was 5:3. After Susan gave $20 to Mary, they had an equal amount of money each. How much money did Mary have at first?

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<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Susan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mary</td>
<td></td>
<td>$20</td>
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Investigating Real-life activities

Investigating Number Patterns

Mathematics Modelling

Investigative Project:
Are there any other number patterns which you can think of? Use the space below for your workings and share with your friends!

\[
\begin{array}{c|c}
\frac{1}{33} & 0.0303030303 \\
\frac{2}{33} & 0.0606060606 \\
\frac{3}{33} & 0.0909090909 \\
\frac{1}{22} & 0.0454545454 \\
\frac{2}{22} & 0.0909090909 \\
\frac{3}{22} & 0.1363636363 \\
\frac{1}{99} & 0.0101010101 \\
\frac{2}{99} & 0.0202020202 \\
\frac{3}{99} & 0.0303030303 \\
\end{array}
\]
Hands-on Investigations

- Conducting a fair investigation by identifying variables which should be kept constant or changed, managing complexities in the design of investigation.

- Collaborating to collect, analyse and explain data (e.g. to explain which materials are better conductors of heat based on evidence).

- Exercise sound reasoning and decision-making, using the findings from the investigations in everyday life applications (e.g. to design a container of appropriate materials for use in everyday life).

In these learning experiences, students have opportunities to apply science concepts and skills to:

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Examples of Learning Experiences which Promote Critical and Inventive Thinking in Science Teaching and Learning

Hands-on Investigations

e.g. planning and carrying out an investigation to show how water is transported in plants

In these learning experiences, students have opportunities to apply science concepts and skills to:

- plan and carry out an investigation to explain a process or a phenomenon (e.g. to show how water is transported in plants)

- evaluate peer’s investigation, considering different ideas and perspectives (e.g. different ways to investigate water transport in plants)

- observe and compare findings in different investigations to make inferences (e.g. to use evidence to infer how water is transported in plants)
Example of Learning Experiences which promote Critical and Inventive Thinking in the Teaching and Learning of History

Inquiry: Did the Cold War end due to pressure from above or pressures from below?

- Teacher guides students to question what they see in pictures
- These questions will enable students to probe and analyse how the pictures provide evidence on the end of the Cold War
- Students then construct a substantiated argument using evidence derived from the pictures
Summary

- Curriculum articulations that support thinking and creativity
- Efforts to promote enactment of CIT
- Examples of enactment
Thank you