

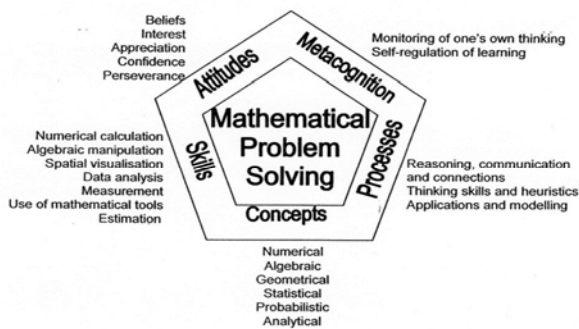
Use of Comics in Teaching Secondary Mathematics and Some Learning Points from Practitioners

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Outline of Presentation

- Theoretical Framework
 - Education from Communication Perspective
- Examples of Contextualisation
 - Building a Culture of Learning
- The Comics Project
- Some Learning Points
- Other possible extensions
- Conclusion

Mathematics Education in Singapore



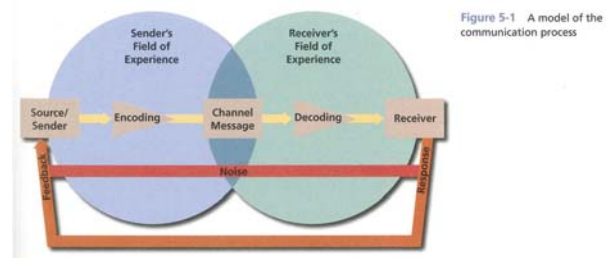
THEORETICAL FRAMEWORK

- Education from Communication Perspective

Education – from Communication Perspective

- What is communication?
 - Passing of information
 - Exchange of ideas
 - Establishing a commonness of thought between a sender and a receiver

Education – from Communication Perspective



Education – from Communication Perspective

- Factors affecting success of communication
 - Nature of message
 - Audience's interpretation of message
 - Audience's perception of the source
 - Environment in which message is received

Education – from Communication Perspective

- Source Encoding
 - Selecting appropriate words, symbols, language to present the message.
 - Putting ideas, thoughts into symbolic form.
 - Encode it in such a way that it can be easily understood by the receiver.

Education – from Communication Perspective

- Channel
- Receiver / Decoding
 - Transforming the sender's message back into thought.
 - Dependent on receiver's frame of reference / field of experience.

Education – from Communication Perspective

- Breakdown in communication???
 - Different fields of experience
 - Advertisers spend much money to understand their consumers – their fields of experience

Education – from Communication Perspective

- Noise
 - In the process of communication, there are extraneous factors that can distort or interfere with the reception.
 - Errors with encoding & decoding phase of the message.

Education – from Communication Perspective

- Responses / Feedback
 - Storing information in their memory
 - Ask questions, give immediate feedback

Education – from Communication Perspective

- We also want our students to have a change of attitude
 - From persuasion theory, attitude is a *learned* behaviour;
 - Attitude translates to thought and action
- Persuasion versus coercion

Education – from Communication Perspective

- Mere repeated-exposure theory
 - The more an individual is exposed to a communication, the more likely the individual will buy-in the message proposed.
 - This theory has been applied to many real-world communication.
 - Will be true provided that the individual does not develop negative feeling through repeated exposure.

Contextualisation of Mathematics

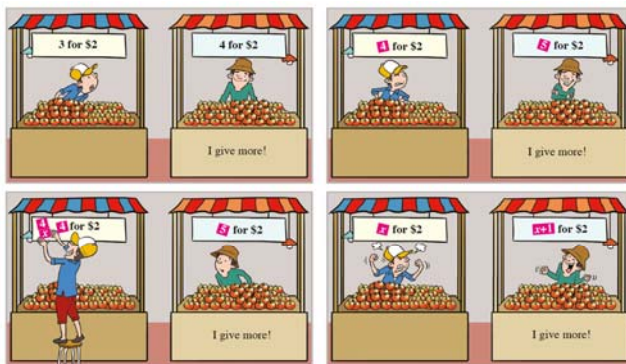
- Building a culture of learning

Building a Culture of Mathematics Learning



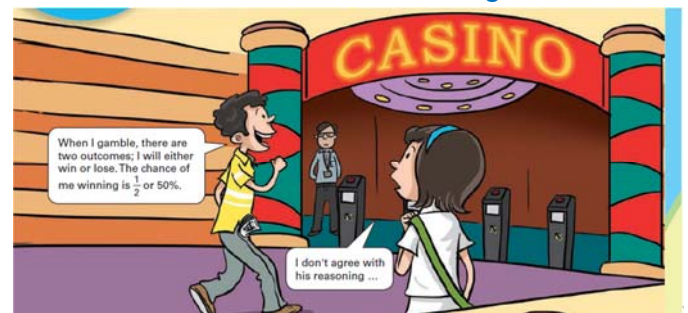
Building a Culture of Mathematics Learning

- Some humour...



Building a Culture of Mathematics Learning

- Critical mathematical reasoning...



Building a Culture of Mathematics Learning

- Teaching procedure through storytelling

Balance Scale	Equation
<p>2 equal bags of gold coins and 1 gold coin balance 5 gold coins. Can you guess how many gold coins there are in each bag?</p> <p>When ... That is easy.</p>	$2x + 1 = 5$
<p>Do 2 bags of gold coins balance 4 gold coins. Group the 4 coins into 2 equal groups. Hence, there are 2 gold coins in each bag.</p> <p>You are right!</p>	$x = 2$
<p>Remove 1 coin from each side. The scale will balance!</p> <p>Is that all you need to do?</p>	$2x - 1 = 4$

Building a Culture of Mathematics Learning

- Develop story of three boys' adventure in Algebra Land...



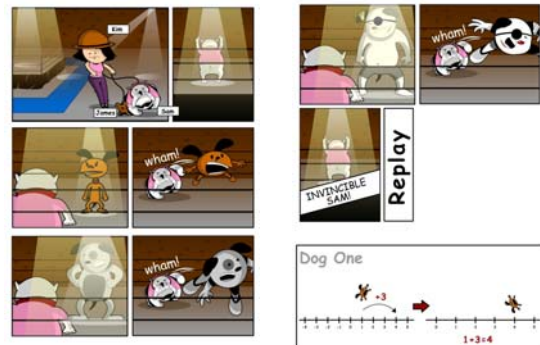
Building a Culture of Mathematics Learning

- Comic strips to develop whole story...



Building a Culture of Mathematics Learning

- Comic strips to develop whole story...



THE COMICS PROJECT

- An introduction to what has been done and what can be done.

THE COMICS PROJECT

- Development (comics + questions + lesson outlines)
 - Two Sec 1 NT chapters
 - Three schools participated
 - Student performance in mathematics achievement test?



THE COMICS PROJECT

- Development (comics + questions + lesson outlines)
 - Significant improvement in attitude / appreciate the relevance of mathematics to daily life
 - Change in students' motivation and academic self-concept
 - One school reported the students performed better in the intervention topics compared to the others

THE COMICS PROJECT

- Infrastructure
 - We have developed an online system for the comics in the NIE website:
<http://math.nie.edu.sg/magical>
 - Online comics + practice questions
 - Online tracking of student performance in the practice questions ...

LESSON DESIGN

- Some Ideas about Comics in Mathematics Classroom
 - Students actively constructing the story
 - Students take ownership in the story (by role-play)
 - Flipped Classroom
 - Higher Order Thinking (problem solving and problem posing)

LESSON DESIGN

- Storytelling
 - An effort to contextualize mathematics
 - The comics package provides an alternative teaching package for the corresponding chapters (align the comic strips with the content, inclusive of practice questions for reinforcement, a corresponding set of lesson outlines on the story used to explicate the various mathematical concepts within the chapter)

LESSON DESIGN

- Several comic strips based on day-to-day experience (to align with students' field of experience) were designed.
- These comic strips were aligned to *all* the mathematical concepts.
- A set of lesson outlines was provided to avoid noises of communication during the lesson, and that teachers are able to focus on the key aspects of lesson delivery.

LESSON DESIGN

- During lessons, mathematical concepts are introduced via the story illustrated by the comic strips.
- At appropriate junctures, practice questions were introduced to reinforce the related mathematical concepts.
- Both online and hardcopy versions of comics are available for teachers to select based on their professional judgement.

LESSON DESIGN

- Use of “lame jokes” to convey mathematical ideas.



LESSON DESIGN

- Use of “language” as a platform for further discussion
 - What is 100%?
 - Refund 150%? Does it make sense? Under what context?



SOME LEARNING POINTS

- Use of Role-Play
 - More opportunity for students to participate in the construction of knowledge;
 - Give students greater ownership to assume responsibility for their own learning;
 - Reflect on their own learning.

SOME LEARNING POINTS

- Students to complete the story, especially the “mathematical” part of the story...
 - Teacher explanation
 - Teacher modelling
 - Student practice

SOME LEARNING POINTS

- Teacher interjects the comics with their own life experience with extreme cases that can impress upon their students - this further captures the students’ attention.
 - “XXX travels by bus to school everyday. It costs \$0.80. Suppose one day she decides to travel by taxi everywhere, which costs about \$12. What is the percentage increase on her expenditure?”

SOME LEARNING POINTS

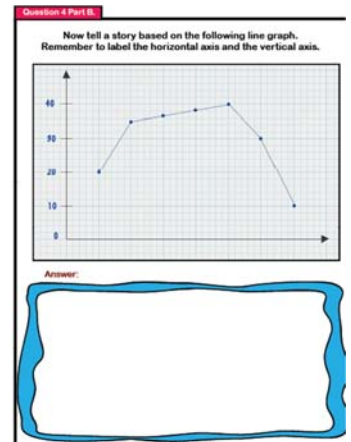
- Students were able to respond to the “lame jokes” and were not “misled” by the “casual” language of the comics.
 - “What an irony...”
 - “It’s so funny...”

OTHER POSSIBLE EXTENSIONS

- Statistics comics: engage students to think more on how surveys are conducted, and how reliable the survey results reflect the true population.
 - Idea of sampling
 - The dynamic nature of opinions
 - Hands-on activities on data collection

OTHER POSSIBLE EXTENSIONS

- Telling their own stories allows students to deepen their understanding of mathematical / statistical concepts.



OTHER POSSIBLE EXTENSIONS

- A good opportunity to develop 21cc according to the Singapore 21 cc framework.

OTHER POSSIBLE EXTENSIONS

- Not necessarily restricted to Low Attainers in Mathematics. Can use comics as a platform to develop problem solving habits.
 - Problem solving tasks can be obtained from day-to-day events ...
 - <http://math.nie.edu.sg/mprose>

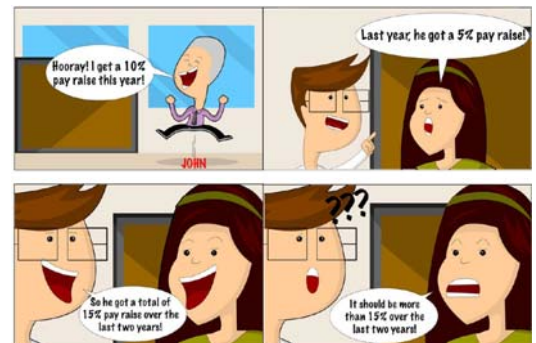
OTHER POSSIBLE EXTENSIONS

Comics as a platform for problem solving...



OTHER POSSIBLE EXTENSIONS

Comics as a platform for problem solving...



OTHER POSSIBLE EXTENSIONS

Comics as a platform for problem solving...



OTHER POSSIBLE EXTENSIONS

- Use of appropriate prompts to develop students' thinking
- Emphasis of the entire problem solving process (Understand the Problem → Devise a Plan → Carry out the Plan → Check and Expand)

Conclusion

- Use of comics: another feasible approach of teaching mathematics
- Platform to get students to actively engage in constructing their own knowledge.