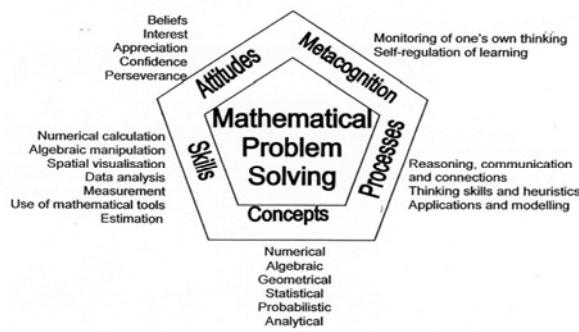


# Use of Comics in Teaching Secondary Mathematics and Some Learning Points from Practitioners

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## Mathematics Education in Singapore



## Education – from Communication Perspective

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

## 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

## THEORETICAL FRAMEWORK

- Education from Communication Perspective

## Education – from Communication Perspective

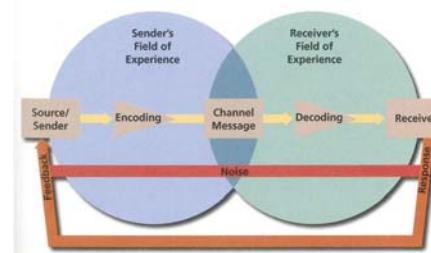


Figure 5-1 A model of the communication process

## 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 to 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

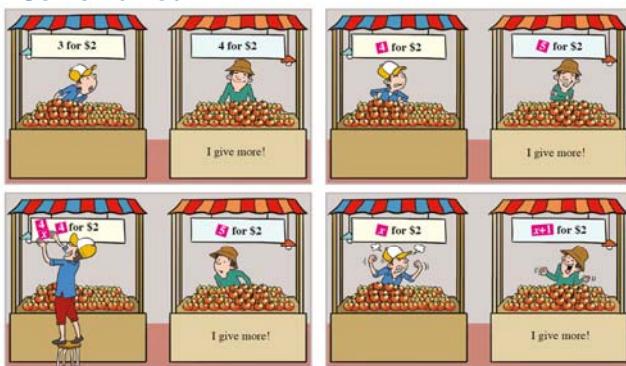
- Building a culture of learning

## Building a Culture of Mathematics Learning



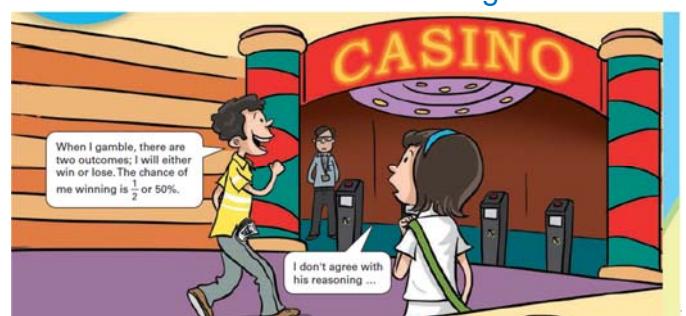
## Building a Culture of Mathematics Learning

- Some humour...



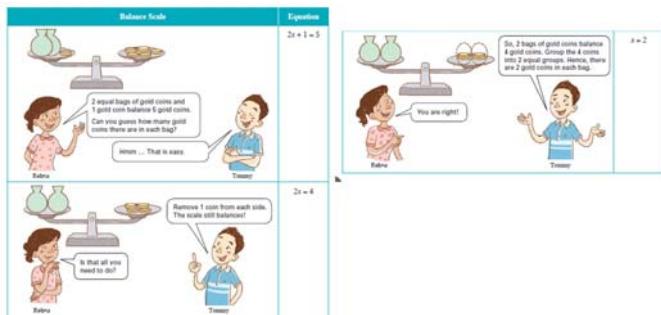
## Building a Culture of Mathematics Learning

- Critical mathematical reasoning...



## Building a Culture of Mathematics Learning

- Teaching procedure through storytelling



## Building a Culture of Mathematics Learning

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



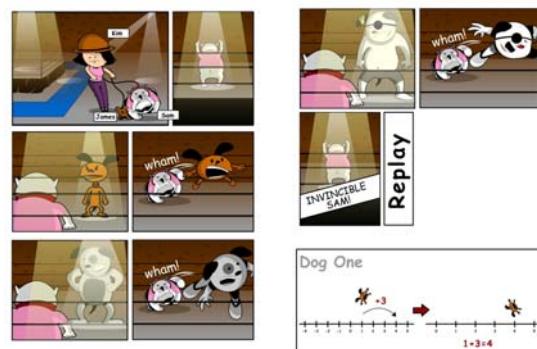
## Building a Culture of Mathematics Learning

- 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

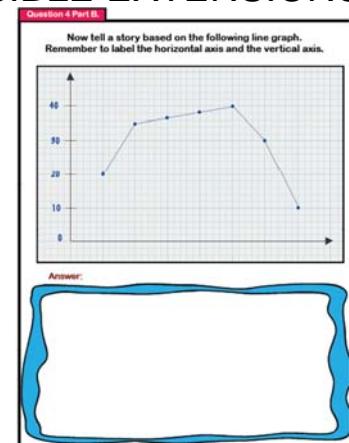
- Students were able to respond to the “lame jokes” and were not “misled” by the “casual” language of the comics.
  - “What an irony...”
  - “It’s so funny...”

## 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.