#### *ECE4020 Lecture #1*

Course Examiner:

Dr Noel Geoghegan

Course Outline

Assessment

# Textbook "Early Childhood Mathematics" by Susan Sperry Smith

**NCTM** 

National Council of Teachers of Mathematics

**NAEYC** 

National Association for the Education of Young Children

#### Continue reflection on .....

**CREATIVITY** \* Functioning creatively as mathematical thinkers

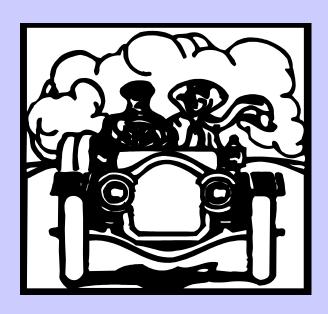
**PROBLEM SOLVING** \* Thinking about how to use mathematics

#### PROBLEM-CENTERED LEARNING

\* Classroom environment that encourages thinking about mathematics

### Mathematics is everywhere

Mathematics is part of our daily lives



#### Six myths about teaching mathematics

### Myth 1: Some people are good at maths and some aren't

- TIMSS Trends in International Mathematics and Science Study (N=46) x 4<sup>th</sup> & 8<sup>th</sup> grades
- PISA Program for International Student Assessment (OECD) at age 15 years
- NCTM Standards Principles and Standards for School Mathematics (2000)
- UK Numeracy Statement (the numeracy hour)
- Australian National Statement (new moves COAG/MERGA)
- EQ Mathematics syllabus (2004-2005)

It's not the *mathematics*.... but it's the *way it's taught* – (therein lies the challenge)

### The past versus a futures outlook

- Speed
- - over meaning
- Rote
- over rational
- Procedural
- over conceptual
- Instrumental
- over Relational
- (Skemp, 1976)

# Myth 2: Mathematics anxiety isn't real. (Not True!)

- Inverse relationship between maths and anxiety
- More females suffer math-phobia
- Attitude counts

### Maths anxiety

#### **GOLDEN RULE:**

Never admit that you fear mathematics or that you are "no good" at it – attitude counts

### Mathematics anxiety..... not all areas are the same

- Maths is **NOT** just **number** there are other areas .....including ....
- Geometry (Space),
- Measurement,
- Chance and Data,
- Patterns and Algebra

### Myth 3: You need a textbook to really teach mathematics

- Textbooks can do more damage than good
- School districts in USA adopt a single text
- Teacher's manuals are a better reference the manuals are sources of lots of ideas and content ("how to" and "why") not just "what to"
- Integration over-rides the textbook approach
- "New Basics" by Education Queensland

New Qld Maths syllabus ..... the heart and soul of the new curriculum is problem solving — investigation....complex thinking... deep understanding...responding... communicating...reflecting

# Myth 4: Calculators belong in the upper grades

- children use technology
- facilitating the learning is the role of ICT
- saves time to concentrate on other thinking
- extends exploration of maths ideas
- provides another tool for problem solving
- 21st century operation

### Myth 5: Manipulatives have few drawbacks

- discrete materials beans, blocks, counters
- continuous materials rods, MAB, number lines
- proportional materials (models)— bean sticks, MAB, Unifix tens
- non-proportional materials (models) –
   abacus, money, colour code

### Myth 6: There isn't enough time to do assessment in a real classroom

- instruction time is precious with so many admin demands
- assessment should not be static
- on-going assessment is vital always looking for vital signs – recording progress
- collecting observations, records, lists, notes, documentation, artifacts profile of child
- evidence accountability ->> progress
- monitor and assess in order to plan and modify

- low representation of female maths (and science) graduates at university
- indigenous students are under represented in achieving mathematics outcomes
- other cultural groups are under represented in achieving mathematics outcomes

- "Think-Pair-Share" strategy to encourage communication
- use "English Experts" strategy involves translating ESL thoughts amongst children to teacher
- gifted children need extra attention too

- very few children are disabled in mathematics –
   most children can comprehend concepts
- teaching rather than "thinking ability" is the culprit for under achievement in maths
- special needs children require more patience, involve more time, and more opportunities to engage with others in a non-threatening environment

- NCTM Standards (2000) has CONTENT and PROCESS standards.....but common characteristics exist across syllabuses, organisations and continents...
- 1) developmentally appropriate approaches
- 2) inclusive and equitable practices for all children
- 3) well-prepared teachers content and process
- 4) problem solving curriculum (pose problems, involve precise language, foster communication)

- 5) integration of maths with other subject areas (not subject isolation)
- 6) inclusion of technology
- 7) professional disposition towards being a reflective practitioner ("lifelong learning")

• AP – age appropriateness (physical, emotional and cognitive development in each age span)

• IP – individual appropriateness (interests, abilities, prior knowledge, home and culture)

# Constructivism – exploring and building "knowing"

- a way of knowing explains how knowledge is gained.
- an epistemology an explanation of what it means to know something.
- knowledge is created ...not transmitted.
- meaning is developed from within not from without.
- mathematical knowledge is recreated and reinvented every time a child makes meaning.

# <u>Jean Piaget</u> (1896 – 1980) was a constructivist

- from Switzerland Geneva.
- stages of development (stage 2 preoperational thinking ages 2-7) a time of rapid development in language and use of symbols.
- how a child thinks how meaning is accommodated and assimilated – how sense emerges – the process as much as the product is important.

# Learning requires: (Piaget)

- self initiated propositions
- active involvement
- rich environment
- developmentally appropriate propositions
- child-centered (not adult-centered) focus
- constructing ideas (not ingesting others') (transmission of ideas is not feasible)

# <u>Lev Vygotsky</u> (1896 – 1934) was a social-constructivist

- from Russia
- has come into prominence in the last 30 years
- learning takes place in the Zone of Proximal Development (ZPD)
- talk to your "self" (private speech) and talk to your "others"
- the culture of a dialogic community
- scaffolding support by an "other" to explore so that the unknown merges into the known – not spoon feeding <u>but</u> sharing and exchanging viewpoints and perspectives to make sense collectively

### Teachers are always:

- (1) looking to ascertain the child's thinking, and
- (2) searching for what makes sense to the child to know what to explore next

• David Hawkins – "You don't want to cover a subject; you want to uncover it."

### **Zoltan Dienes** – USA

- Free play
- Generalisation
- Representation
- Symbolization
- Formalisation

#### Jerome Bruner (1915 - ) USA

• Intellectual capacity develops from enactive to iconic to symbolic modes of knowing

Levels of knowing

Concrete

----- Iconic

----- Symbolic

$$(------)$$
 Abstract)

### Levels of knowing...

• For example.....

• 3000rpm ~ 100bhp in  $2^{nd}$  gear. Is 3000rpm in  $3^{rd}$  gear  $\geq$  100bhp?