Some Learning Theories

CCM201 : Teaching and Learning of Primary School Mathematics

Lecturer

- Toh Tin Lam
- Office: 7-03-43; Tel: 6790-3898
- Email: tltoh@nie.edu.sg

- If you have any query about this lecture, consult your tutor or email me.
- File will be posted later in Blackboard.

Lecture Outline

- Behaviourist Theory
- Skemp's Theory
- Bruner's Theory
- Piaget's Theory
- CONCLUSION

Why Study Learning Theories?

- Understand the rationale (theories) behind common teaching practices, go beyond "common sense".
- Theories as guide and inspiration for different teaching techniques.
- Theories provide language of the teaching profession; discuss education issues with colleagues.
- Numerous theories, only a few key ones here. http://tip.psychology.org/theories.html

Scenario

- Teacher explains and demonstrates how to perform a rule, e.g., 34 + 47 = 81
- Pupils listen and pay attention.
- Pupils practice rule with other examples.
- Teacher rewards those who can do.
- Teacher re-explains to those who make mistakes.

Behaviourism: Traditional

- Scenario is most common situation.
- Traditional chalk and talk method:

  explain → practice → feedback
- Based on Behaviourism: learning consists of changes in observable, measurable behaviours based on stimulus (S) and responses (R).

Behaviourism: Traditional

Stimulus → Response

12 x 12 = ☐

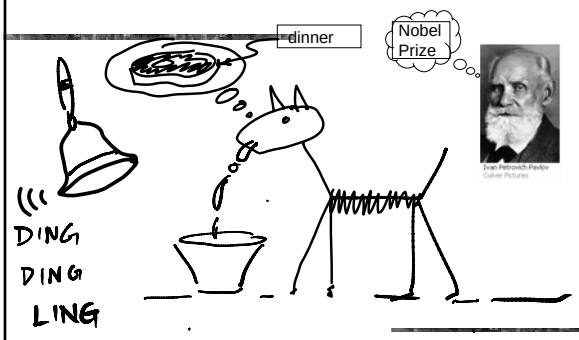
13 x 12 – 12 = ☐

Learning – Establishing S – R Bonds

Behaviourism: Key Proponents

- **Pavlov (1849-1936, won Nobel Prize for Medicine on digestive glands); on dogs**
- **Watson**
- **Thorndike (1874-1949);**
  on cats & pigeons, applied ideas to teaching of arithmetic.
- **Skinner (1904-1990); on rats**

Ivan Palvov (and dog)



Palvovian Conditioning

Bell	→	Neutral No automatic reaction
Food	→	Salivate
Bell+Foodl	→	Salivate
Bell	→	Salivate

Palvovian Conditioning

Math Lesson	→	Neutral No automatic reaction
Lack of success	→	Dislike
Math Lesson + Lack of success	→	Dislike
Math Lesson	→	Dislike

Implications

Try connect mathematics and its teaching and learning with something that generate positive feelings – pride, pleasant, fun, enjoyable, sense of achievement, etc.

B. F. Skinner - Behaviourism

Operant conditioning: Changing behaviours by manipulating its consequences – reinforce desired behaviours

Shaping – reinforcing responses that get closer and closer to desired behaviours.

Implications

Catch them doing well and "reward" them

Build in and celebrate student success

Identify the components (S-R bonds) of a complex mathematical task and sequence them accordingly SIOs, Task analysis, etc.

Get to know the students – their reinforcers and non-reinforcers.

Relational vs Instrumental: Skemp

- **Instrumental understanding: know how to do something without knowing why.**
- **Relational understanding: know how and why.**

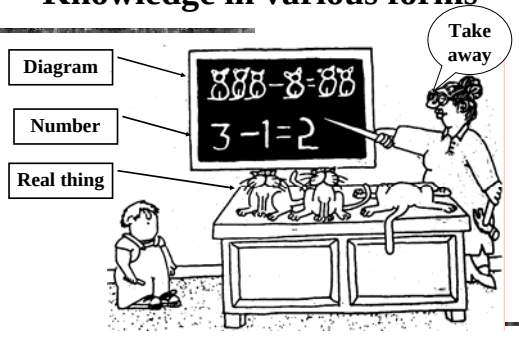
Bruner's 3 Modes

- **Mathematics can be represented in several ways.**
- **Bruner's 3 modes:**

Enactive → **Iconic** → **Symbolic**

Child's experience with the object, adding and removing the objects.....

Knowledge in various forms



Structure of Mathematics

- **Bruner stressed the structure of mathematics: concepts, principles, processes. How they fit together.**
  - ***"We teach a subject not to produce living libraries on the subject but rather to get a student to <u>think mathematically</u> for himself."***
- **Bruner's most famous quotation.**
  - ***"Any subject can be taught to anybody at any age in some form that is honest."***

Discovery Approach

- **Bruner proposed the "discovery" approach.**
- **"Guided discovery": help pupils discover mathematics by working through the various representations.**
- **Use worksheets.**

Spiral Approach

- **Bruner also proposed the spiral approach.**
- ***"In the syllabus, the spiral approach is adopted to ensure, where possible, that each topic is covered at appropriate levels in increasing depth to enable pupils to consolidate the concepts and skills learnt and to develop further concepts and skills"***

Jean Piaget (1896 – 1980)

Jean Piaget
THE BETTMANN ARCHIVE

4 Stages of Piaget's Theory of Cognitive Development

- **Sensori-motor (0 – 2, approx)**
- **Pre-operational (2 – 7, approx)**
- **Concrete operational (7 – 12, approx)**
- **Formal operational (> 12, approx)**

Our primary school pupils are concrete thinkers.

Concrete Operational

- **Thinking related to physical objects and events.**
- **Conservation: mass (8+), displacement volume (13+).**

Conserve Volume

Concrete thinkers should be able to conserve volume.

Concrete Operational

- **Reversal thinking, e.g.,**

  2 + 7 = 9, so 9 – 2 = 7
- **Transitivity: e.g.,**

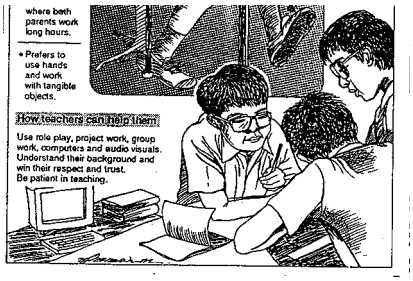
  if a > b, b > c, then a > c.
- **Sociocentric: become aware of the views of others.**

Manipulatives

- **From concrete, familiar experiences to abstract concepts. Show link between concrete and abstract.**
- **"Manipulation of materials is crucial. In order to think, children in the concrete operational stage need to have objects in front of them that are easy to handle,**
- **or else to visualize objects that have been handled and that are easily imagined without any real effort."**

Manipulatives

Use multi-sensory activities.
I hear and I forget.
I see and I remember.
I do and I understand.



Readiness

- **Development cannot be accelerated; fail to learn because pupils not ready for the concept. Controversial!**
- **Different from Bruner's 3-modes, which apply at any age.**

Time Factor

- **Give more *time* to move to a higher stage.**
- **"If we were willing to lose a bit more time and let the children be *active*, let them use trial and error on different things, then the time we seem to have lost we may have actually gained.**
- **Children may develop a *general* method that they can use in other areas."**

Key Message

Pupils are *not* empty vessels

for teachers to fill in mathematics rules …

Make learning an active process.

Final Remarks

- **Use a variety of theories when you plan lessons.**
- **Find out how well these theories work for your lessons.**
- **You will become a wiser and better teacher!**