LECTURE WEEK 5

PSYCHOLOGY OF MATHEMATICS LEARNING

www.besmart.uny.ac.id

ENDAH RETNOWATI

e.retno@uny.ac.id
Where are we up to ...

- Week-1: Behaviourist vs cognitivist
- Week-2: How students process info
- Week-3: Knowledge & Schema
- Week-4: Schema construction & automation
- Week-5: Encoding – how get the knowledge into LTM
- Week-6: Retrieval – how take the knowledge out from LTM
- Week-7, 8, 9: Social cognitive factors
- Week-10: Mid-term exam
Can you explain?

- How students process information during mathematics learning
- How perception, attention and pattern recognition influence mathematics learning
- How the limitation of working memory when dealing with new or complex information influences mathematics learning
- How student construct mathematics knowledge (schema)
- The implication schema automation on mathematics learning
Today ....

Encoding
LEARNING PROCESS:
organise information, build connection among information and integration with prior knowledge, and eventually construct knowledge, encode knowledge to LTM.
What is encoding?

- Transforming an experience into a durable memory trace (Davachi, 2008)
- Process of converting information from sensory to WM and WM to LTM
- “getting information in” (Myers, 1998)
What is encoding?

- First step in information processing model
SM to WM

- Sensory memory is bombarded with information
  - Attention is directed to important and novel stimuli
  - Determines automatically (via LTM)
WM to LTM

- Most of our focus is now on encoding to LTM
Importance of encoding

- Necessary part of our memory system

- How something is encoded determines:
  - How learned information is more memorable
  - How knowledge is constructed
  - How well knowledge is stored
  - How easily knowledge is retrieved

- This is integral to learning
Encoding

- How is information encoded?
  - Effortful processing
  - Automatic processing

- Effortful processing = deliberate focus of attention
  - e.g. $(x + a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$

- Automatic processing = no intentional effort
  - e.g. $A = \pi r^2$
Encoding of LTM

- Implicit memory
  - Always automatic encoding and recall
  - Give example!

- Explicit memory
  - Can be automatic or effortful
  - Give example!
Automatic processing occurs:

- Without awareness
- Without hindering or interfering with other thoughts and processes
- Without choice
Automatic processing

- Much processing is automatic
  - Time, space, etc
    - e.g. running into a friend, recognising face, looking at volume
  - Well learned information
    - e.g. meaning of daily conversation, simple arithmetic operations

- Effortful processing typically becomes more automatic with practice
  - e.g. reading, drawing a graph, writing
Effortful encoding strategies

- Effortful processing strategy employed depends on the material to be encoded
  - Simple material
    - e.g. lists of facts, symbols, short formula, name, ...
    - rehearsal
  - Complex material
    - e.g. number theory, quadratic equations, differential equations, problem solving
    - Advanced organiser
    - Schema activation
Simple material: rehearsal

- Information can be rehearsed for maintenance or elaboratively rehearsed.
- Where does it occur? Conscious?
Simple material: Rehearsal

- Maintenance rehearsal
  - Direct recycling
  - Maintains info in consciousness
  - Often short term
    - i.e. doesn’t always reach LTM

- e.g. repeating a formula over and over in preparation to do a quiz
Simple material: Rehearsal

- Elaborative rehearsal
  - Relating material in question to other material
  - Encodes for storage (into LTM)
  - More enduring than maintenance rehearsal
  - Strategies include mediation, mnemonics and imagery
Elaborative rehearsal: (I) Mediation

• Mediation involves mentally linking information to be processed with something more meaningful

• Mediation theory and research based on processing of nonsense syllables
  ◦ e.g. ‘ris kir’ becomes ‘race car’
Elaborative rehearsal: (1) Mediation

- **Advantages**
  - Simple, easily learned rehearsal strategy
  - Mediators have better subsequent recall than non-mediators
    - Deeper processing

- **Disadvantages**
  - Only applicable to a limited range of information
Elaborative rehearsal: (2) Imagery

- Recall Paivio’s dual coding theory
- Information is coded via two systems (and subsequently stored in LTM):
  - Verbal
  - Imaginal
- Imagery involves creating images to accompany rehearsal of verbal material
  - Should enhance encoding
Elaborative rehearsal: (2) Imagery

- Recall that concrete words better visualised than abstract ones
- Imagery can be extended from words to complex concepts, people and so on
Elaborative rehearsal: (2) Imagery

e.g. remembering that ‘diagonal’ is a segment connecting two not-consecutive angles
Mnemonics are memory strategies or encoding ‘tricks’

To be learned information is paired with well learned information

Components of a mnemonic can include:
- Rhymes
- Imagery
- Acronyms