**Learning through verbalization (2): Understanding the concept of “schema”**

How to balance between concrete experiences and their abstraction?

- Ample practice with reflection solicits natural generalization.
- A short demonstration with a highly abstracted explanation might appear to save time, but could impair the quality of learning.

---

**Undergraduate Cognitive Science courses**

1. Solving problems
   - Class 1: 3 (n=81)
   - Class 2: 23 (n=71)
   - Class 3: 201 (n=92)

2. Strategy choice
   - “What strategy would you use to solve many day problems?”

3. A transfer problem
   - “m + b = ?”

4. Instructions for abstraction
   - Class 1: “What kind of knowledge were your rules?”
   - Class 2: “Explain how to solve the day arithmetic to your friends.”
   - Class 3: “What is the most important point of the day’s lesson?”

---

**Coding categories and examples**

- **Memory**: Rote memorization
- **Table**: Look-up tables
- **Rules**:
  - “To add a Sunday, the addend is the answer.”
  - “To add a Monday, choose the next day of the addend,”
  - “To add a Saturday, choose the previous day of the addend.”

- **Effective practice of rules** are generalize-able only after ample practices.

**Answer patterns: Coding criteria**

- **Count-up**: Count from ‘a’ to ‘m(13)’ and ‘b(2)’, get “13+2=15” and figure out its correspondent in the alphabet as ‘o’.
- **Transfer**: Generate and apply an isomorphic rule like “To add ‘b’, choose the next-next letter of the addend.”

- **Effectiveness of rules” are generalize-able only after ample practices.**

---

**Abstraction levels of summaries**

- **Concrete**: Specific procedures only
- **Moderate**: Strategies and their effects
- **High**: Commonality of strategies

---

**Answer types of “m + b”**

- **Class 1**: 3% (n=81)
- **Class 2**: 23% (n=71)
- **Class 3**: 201% (n=92)

---

**Day Arithmetic” problem**

When Wednesday + Tuesday = Friday, what is Tuesday + Friday?

---

**Concrete experience is the basis for significant reflection.**