The dynamic jigsaw: repeated explanation support for collaborative learning of cognitive science

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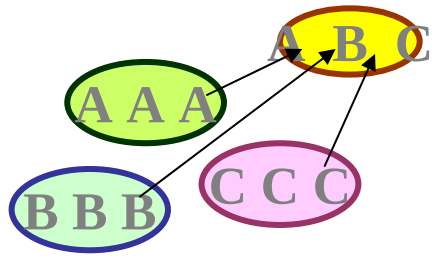
Outline of this talk

- What should be the learning objectives for undergraduate cognitive science courses, and how well are the students learning?
  - Comparison of lectures vs. simple jigsaw.
- Design collaborative learning activities,
  - Dynamic jigsaw
- Evaluate outcomes in terms of concepts the students created about cognitive science.

Learning objectives

1) Students should gain basic cognitive science concepts and theories to become able to
   - solve problems better,
   - learn better, and
   - make more intellectual judgments about human cognition.
2) What is learned has to be usable when they become necessary,
3) in real world situations.

How much are the students learning?



- Active learning (e.g. jigsaw)
  - Students exchange self-generated explanations and collaboratively reflect.
- Passive learning (e.g. lecture)
  - Students listen to lectures, take notes, make short summaries and comments.

Remembering “lectures”

5 months after the class

“ (What do you remember?) … uhh, he talked about meta-cognition, and uhh, he talked about the baseball player, Ichiro, and, and …that’s about all.”

Class type	# of topics	% recall Themes + Implication	% recall Keywords only
Lectures	24	2.1%	29.1%

n=12 out of 70

Remembering from jigsaw

EXP: What did you read? What kind of a story?
ST: Okay. It was about an experiment of pigeon's memory. If we destroy a particular part of the bird's brain, it can still distinguish the edible things from things it cannot eat, but cannot tell a triangle from other figures. So, the functions needed for living are distributed among different parts of the brain, even pigeon's brain"

4 months later

Class type	# of topics	% recall Themes + Implication	% recall Keywords only
Lectures	24	2.1	29.1%
Jigsaw	22	15.8%	7.7%

n=28 out of 85

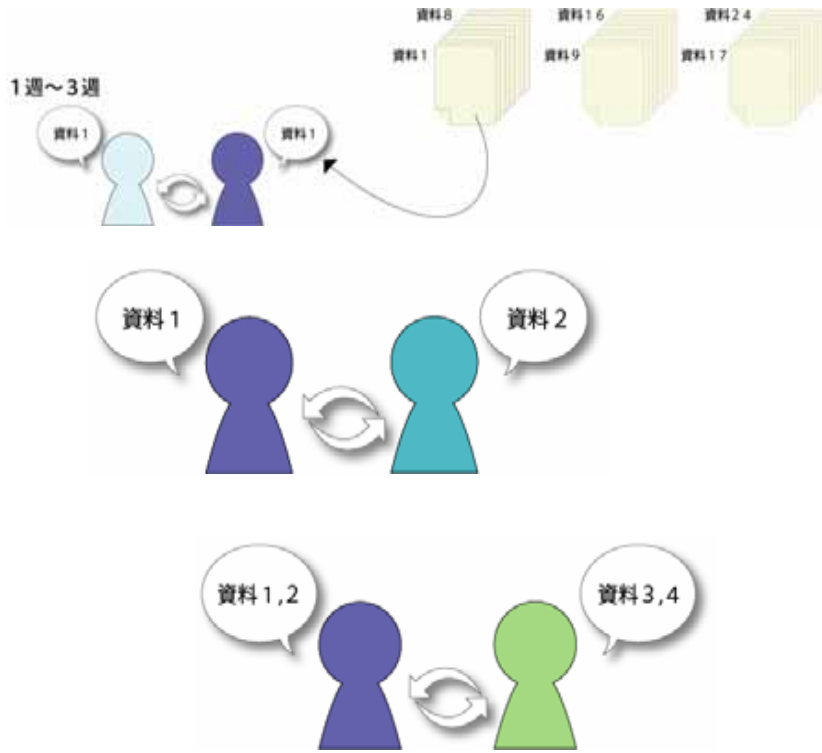
Possibilities for continuous integration

(While reflecting on Bransford & Johnson's study)

So… Uh! By adding redundant information the experimenter can increase or decrease the number of idea units subjects would recall. I think that's the implication of the study. Aha, this is where their study is related to the theory of elaborations of memory!

Implementation: Dynamic jigsaw

- Jigsaw as a tool for collaborative reflection,
- Repeat this to cover 20 to 30 texts of research findings.



Dynamic jigsaw as a scheme for repetition

Among N pieces of literature ($n_{1 \ldots N}$),

- Select one, n_i,
- Become expert of n_i in group of two to three.
- Exchange and seek integration of n_i and n_{i+1}.
- Then $n_i + n_{i+1}$ and $n_{i+2} + n_{i+3}$ (2X2).
- Then $n_i + n_{i+1} + n_{i+2} + n_{i+3}$ and other four (4X4).
- Then 8 by 8, for two times.
- Write a summary of n_1 to N.

"Advanced Cognitive Science" 2004

- Seventy-five sophomores
- Fifteen classes of 90 min/week
- September to December

- The students had studied
  - Problem solving
  - Memory
  - Knowledge representation
  - Introductory perception
  - Theories of expertize

Classes

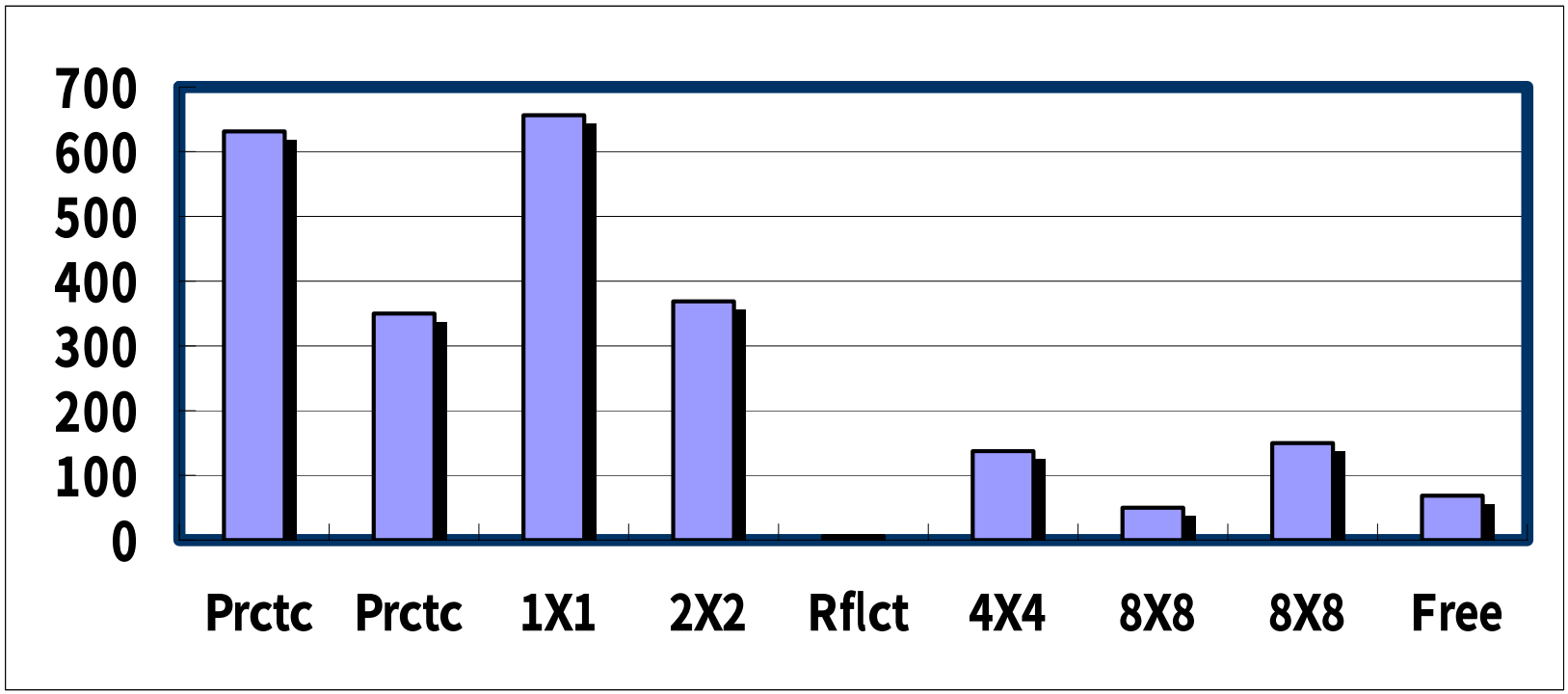
Trajectory of Student Y.O.

- Chose #16 as his "core."
  - "Declarative and procedural knowledge"
- Attended all classes, enjoyed the activities

The dynamic jigsaw for Y.O.

19/Oct	Select 16 of (15, 16)
26/Oct	Answer quiz on 16, 15
02/Nov	Practice explaining 16 to TA
09/Nov	Practice explaining 15 to TA
16/Nov	1X1 15 & 16
30/Nov	2X2 (15,16)&(13,14)
07/Dec	Reflection on 2X2
08/Dec	4X4 (13-16)&(09-12)
14/Dec	8X8 (09-16)&(17-24)
15/Dec	8X8 (09-16)&(01-08)
22/Dec	Reflection on all 24

Length of explanations of 16



Y.O.

Component structure of the explanations

Theme	The theme of the findings
Evidence	Experiments, observations, systems, line of logic…
Implications	Author's interpretations and implications
Connections	Student's interpretations and abstractions

11/09 Practice

12/07 4X4

12/15 8X8

30/Nov -1: After the pair exchanged their practice explanations, YO develops his own interpretation

441-445	YO	I just thought… we might not use procedural knowledge intentionally, but to be conscious about it is, maybe, cognitive science…
446	TN	Ah…
447-448	YO	So, those human behavior is difficult to explain,
449-450	KT	…but we make them explainable in words.
451-464	YO	Let me try again, cognitive science is a process of transforming procedural knowledge into declarative knowledge. How's that?

Evaluation

- Achievement differs individually greatly.
- We have just begun to explore ways of evaluating how these achievements are and/or would be applied to real problems.
- “Microgeneric” data, taken weekly for nearly two years, could now be analyzed to reveal real process of concept formation.