# Teaching Cognitive Science through Collaborative Reflection (2): A Case of Learning Semantic Net Representation

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## Learning Cognitive Science

We have been developing and testing a set of undergraduate curriculum to teach cognitive science [1]. Here we report one particular case of our approach where students learned some basic constructs of human memory. Students gradually integrated pieces of research findings on the "semantic net representation" by the "jigsaw" method, by tying the understanding to their previous experience of analyzing data from classic psychology experiment [2][3]. Learning through collaborative reflection enabled them to clearly understand the reasons why people remember semantic aspects of sentences better than their superficial features and the significance of the results when they were to apply it in real-world problem solving. Students also gained meta-cognitive experiences of becoming an expert on a piece of literature assigned to them and of actively grasping its main points. These experiences provided the students with the base to engage in more rigorous constructive interaction in the latter phase of the curriculum.

## Sequence of Class Activities

We required sophomores to integrate three sections on memory from a standard textbook [4], "elaborations and their network representations," "depth of processing," and "inferential reconstruction in recall," in three 90-minute classes of "Cognitive Science & Experimental Design." Prior to these sessions, students had spent five weeks analyzing the data recreated to represent the main results of Bransford & Johnson [2], and devising analytic measures to capture the effects of a picture on memorizing the sentences.

In the first class, we introduced the three sections from the textbook to reconsider the above study. The seventy-eight students in the class were divided into three, and each student read only one of the three sections. Then the three students who read different sections were gathered to exchange their understanding (the "Jigsaw" method).

In the second class, the students were again divided into three groups to work in separate rooms to be "experts" on their assigned sections. The students worked in small groups to answer questions about the hypotheses, experimental designs, results, and implications of the studies in the section. TAs assisted this process. Students were then asked to summarize the section and rephrase Anderson's concise summary into their own statements.

In the third class, students assembled in one big room to form "jigsaw" groups of three members, to exchange their sections. They were requested to integrate the main claims and pieces of evidence of all the sections in order to answer the question, "What is memory?" To wrap up, they were asked to reconsider the measures they used to analyze the Bransford & Johnson's data.

## Learning Outcomes

At the end of the third class, 54% of the 78 students could refer to the "semantic net" of memory clearly. As in Table 1, students adopted elaborate measures that value gist recall (e.g., number of Idea Units) or reconstruction (number of additional information) more often than adopting measures that value verbatim recall (number of correct sentences). Their understanding of memory improved their measures.

Table 1 Improvement of students' analytic measures

|  | Verbatim | Gist | Reconstruction |
|---|---|---|---|
| Pre-Jigsaw | 62.0% | 43.0% | 3.8% |
| Post-Jigsaw | 13.7% | 68.6% | 15.7% |

## Learning Trajectories

At the end of the first class (the simple jigsaw), half the students expressed they did not understand the material. This motivated them to explore the materials further in the second class. In expert groups, they were observed to actively reconstruct semantic nets and extract experimental results from the texts. During the second jigsaw, they used more concrete examples and summarized as referring to;

1. elaboration facilitates recall (64%)
1.1. by providing additional retrieval paths in net and (56%)
1.2. by permitting recall by inference, (16%)
2. process of meaning promotes elaboration, and (24%)
3. previous knowledge reconstructs the net. (44%)

When we interviewed 25 students six months later, they could still verbalize these points (% shown in parentheses). They often recreated them by integrating pieces of their memory, showing the spontaneous and long lasting learning.

## Acknowledgments

## References

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