

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

Hajime Shirouzu & Naomi Miyake ({shirouzu, nmiyake}@sccs.chukyo-u.ac.jp)

School of Computer and Cognitive Sciences, Chukyo University
101 Tokodate, Kaizu-cho, Toyota, Aichi 470-0393 Japan

Learning Cognitive Science

We have been developing and testing an undergraduate curriculum to teach cognitive science [1]. In this report, we present a case illustrating our approach where students learned basic constructs of human memory. Students gradually analyzed the research findings on the “semantic net representation” by the “jigsaw” method, and integrated it with their previous experience of analyzing data learned from a classic psychology experiment [2]. Learning through collaborative reflection enabled them to clearly understand the reasons why people remembered semantic aspects of sentences better than their superficial features. Students also gained meta-cognitive experiences of becoming experts on a piece of literature and grasping its main points. These experiences provided the students with a base to engage in more rigorous constructive interaction in the latter phases of the curriculum.

Sequence of Class Activities

In three 90-minute classes of “Cognitive Science & Experimental Design,” we required the sophomores to learn three sections on memory from a standard textbook [3], “Elaborations and their network representations,” “Depth of processing,” and “Inferential reconstruction in recall.” Prior to these sessions, the students had spent five weeks analyzing the data recreated to represent the main results of research by Bransford & Johnson [2], and devising analytic measures to capture the effects of a picture on memorizing sentences.

In the first class, we introduced the three sections on memory. The seventy-eight students in the class were divided into three groups, and each student read one of the three sections. Three students who read different sections then convened to exchange their understanding of the reading (the first “jigsaw”).

In the second class, the students were again divided into three groups to work in separate rooms, to become “experts” on their assigned sections. The students worked with TA’s in small groups to answer questions about the hypotheses, experimental designs, results, and implications of the studies in the assigned section. They were then asked to summarize the section by rephrasing the summary provided in the textbook using their own words.

In the third class, students assembled in one room to exchange their sections, again in the jigsaw method (the second “jigsaw”). They were asked to integrate the main points of all the sections in order to answer the question, “What is memory?” To conclude, they were asked to reconsider the measures they had used to analyze the Bransford & Johnson’s data.

Learning Trajectories

At the end of the first class (the first “jigsaw”), half the students stated that they did not understand the material. This motivated them to explore further. In the second class where they worked in “expert” groups, they were observed to actively reconstruct semantic nets and extract experimental results from the texts. During the second jigsaw (in the third class), they used concrete examples more often than in the first class, summarizing them as:

1. elaboration facilitates recall (39%)
 - 1.1. by providing additional retrieval paths in net (19%)
 - 1.2. by permitting recall by inference (23%)
2. processing of meaning promotes elaboration (41%)
3. previous knowledge reconstructs the net (63%)

They integrated these points to understand memory as a semantic net. Forty-two of the 78 students (54%) referred to it accurately by the end of the class. This percentage is substantially higher than that gained in the classes of traditional teaching.

They also applied their understanding to improve their analytic measures, demonstrating their understanding that the semantic aspects of sentences are memorable. As in Table 1, students adopted measures that value gist recall (e.g., number of Idea Units) or reconstruction (amount of additional information) more often than measures that value verbatim recall (number of correct sentences).

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%

By utilizing collaborative and active reading of scientific materials, the students gained a durable understanding of the main points, which could be resources for later reconstruction. When we interviewed 25 students six months later, they could still verbalize the main points or recreate them from memory.

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