

Teaching Cognitive Science through Collaborative Reflection (1): Overview

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Learning Science on Cognitive Science

We have been developing and testing an undergraduate curriculum to teach cognitive science [1][2][3]. In doing so, we rely on existing cognitive scientific research findings and documented ways of thinking. At the same time, we try to integrate our findings to strengthen our understanding of how people learn, and how they implement an information environment suitable for learning. The target is broad, because we believe the knowledge of cognitive science has pragmatic value for most of what we do in our everyday lives.

An Undergraduate Cognitive Science Course

In this overview, we will explain our approach and how we implement it. In a separate presentation, we report a case where the students learned basic constructs of the semantic net representation of human memory[4].

Cognitive Science Learning Objectives

To transfer what they have learned in the class to real-world settings, the students are expected to develop scientific skills and metacognitive procedures including:

- 1) integration skills to tie experiences to research findings,
- 2) inference skills to judge social and cognitive models for observed behavior, and
- 3) inquiry skills to identify research questions, to design and implement tests, and to evaluate the results.

Research Findings We Rely On

In order to promote scientific skills rather than mere memorization of facts, we should devise ways to take advantage of research findings, such as:

- 1) experiential knowledge, when accumulated and reflected upon, restructures itself into generally usable schema, and
- 2) constructive interactions provide the participants with chances to reflect on and restructure their own ideas, on top of our basic understandings of knowledge representation, problem solving, and the situated cognition.

Curriculum Structure and Classroom Activities

The present curricula are for undergraduates and cover two semesters per year, taking four years to complete. In the first year, hands-on experiences of simple cognitive tasks are emphasized and analyzed, first individually and then collectively, across the class. This experience-based understanding is gradually meshed into reading activities of technical materials, to help students gain a deeper comprehension as well as to grasp the breadth of research. In the third to fourth year they are encouraged to engage in

more inquiry-oriented, project-based learning, leading them to graduation research.

Throughout the curricula, we use the jigsaw method, where each member of a group is assigned a part to master and then exchange that information to create a whole understanding. This produces a natural setting to explain what one understands to others, often motivating them for further learning. The students are gradually introduced to the simple jigsaw of two to three parts, to a more complicated and dynamic jigsaw to cover thirty to forty research pieces, by expanding each member's understanding of her/his own interests.

Scaffolds and Evaluation Methods

We use information technology extensively, mainly to keep records, which, over the course of years, accumulate and become a shareable knowledge base. We are currently expanding the system's capability to handle video materials of the classes and of experiments, which both researchers and students can use for reflective purposes.

Such records are constantly examined for formative evaluation. We also interview the students six months to one-year after the end of the classes. During such retrospective interviews, we found that the students sometimes come to realize new aspects or structures of their learned materials. These data show that the learning is a spontaneous, long-lasting process, the outcomes of which we do not yet have a satisfactory cognitive method to evaluate.

What We Have Learned So Far

Through this way of teaching, we have found that the students grasp the materials more than in the more traditional classes. This has helped us to start reformulating our understanding of how people learn, and to identify further research questions. We still have little information about how our knowledge is structured, how we could externalize it for further learning, and how experiences of solving problems at hand form into coherent, general-purpose cognitive procedures. These are old questions, to which new data from teachings of cognitive science may bring new insights.

Acknowledgements

This research is supported by CREST/JSP and JSPS Grant-in-Aid, 12480091 for the first author and 147010003 for the second author.

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