Title

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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 set to teach cognitive science [1][2][3]. To do so we rely on cognitive scientific research findings and ways of thinking. At the same time we try to feedback our findings to strengthen our understandings of how people learn, to implement information environment suitable for learning. The target is general, because we believe the knowledge of cognitive science has pragmatic value for most of what we do in everyday lives.

An Undergraduate Cognitive Science Course

In this overview, we explain what we do and how we do it, with general results. 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 and use what they have learned in real-world settings, the students are expected to develop methods 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, and to design, test, and evaluate the corresponding hypotheses.

Research Findings we rely on

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

1) experiential knowledge, being accumulated and reflected upon, restructures itself into generally usable schema, and
2) constructive interactions provide the participants chances to reflect 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, for four years to finish. In the first year, hands-on experiences of simple cognitive tasks are emphasized and analyzed, first individually and then collectively across the class. These experience-based understandings are then gradually meshed into what the students can find in technical reading materials, which they divide among themselves according to their interests to learn deeply and explain to others, for both helping sharing the learning as well as strengthening one's own comprehension. 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 be an expert on and then gather to exchange what each has learned to cover the whole. This creates a natural setting for explaining what one understands to the others, which often leads 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 understandings of her own interests.

Scaffolds and Evaluation Methods

Information technology is widely used mainly to keep good, sharable records of notes and comments, which, during the course of years, accumulate and become a shared knowledge base. We are currently expanding the system's capability to handle video materials, both of the classes as well as experimental data which both researchers as well as the students can use for reflective purposes.

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

What We Have Learned So Far

The presented way of teaching has yielded among the students much stronger sense-making of the materials than more traditional classes. This has helped us to reformulate how interaction works, and to identify further research questions. We still do not know much about how our knowledge is structured, how we could externalize it for further scrutiny, how experiences form into coherent practical cognitive procedures which let us solve problem at hand, etc. These are old questions, to which new data from teachings of cognitive science may bring new insights.

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