

Foundations of a Theory-Aware Authoring System for Collaborative Learning

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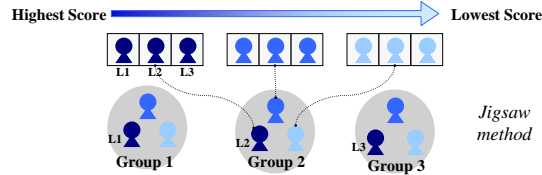
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1) Research Objectives

- To provide formal structures based on ontologies to represent learning theories explicitly and to propose techniques to use them rationally.
- To use *theory-driven group formation* to offer fundamental settings for an effective *Collaborative Learning design* and essential conditions for *interaction analysis*.

2) Usual Approach (Limitations)

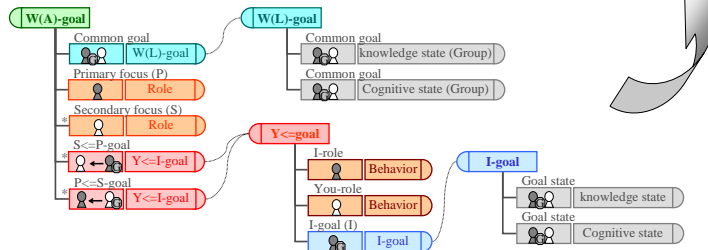
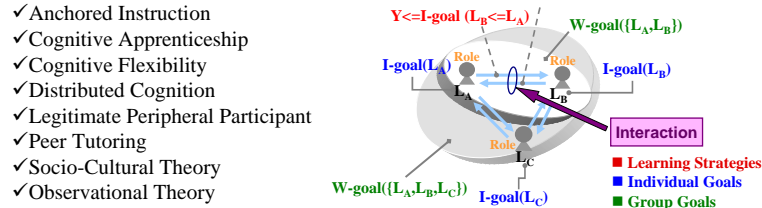
- The use of a set of heuristics to form a group without considering the achievements from the Learning Science Community (especially learning theories);
- Cannot justify its recommendations systematically and scientifically. Example[1]:



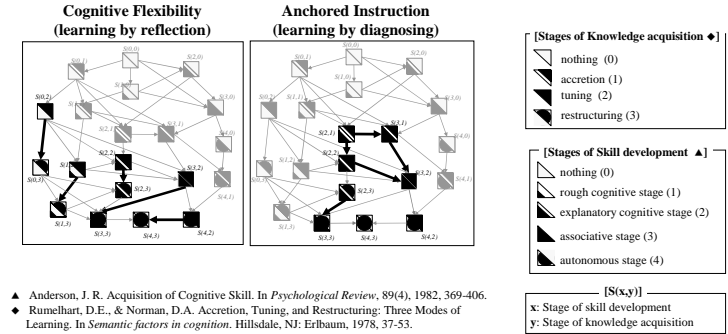
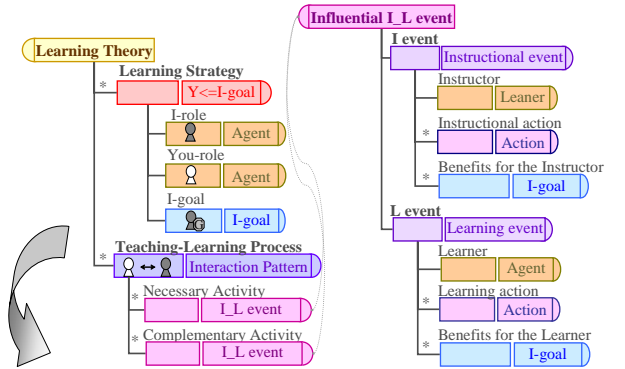
[1] Soh, L., Khandaker, N., Jiang, H. Multiagent Coalition Formation for Computer-Supported Cooperative Learning. In *Proceedings of IAAI'06*, 2006, 1844-1851.

3) Our Approach

- Uses ontological engineering to describe Collaborative Learning and Learning Theory in terms of explicitness, formalism, concepts and vocabulary
- Analysis of several learning theories



Inaba, A., Mizoguchi, R. Learners' Roles and Predictable Educational Benefits in Collaborative Learning. In *Proceedings of International Conference on Intelligent Tutoring Systems*, 2004, 285-294.

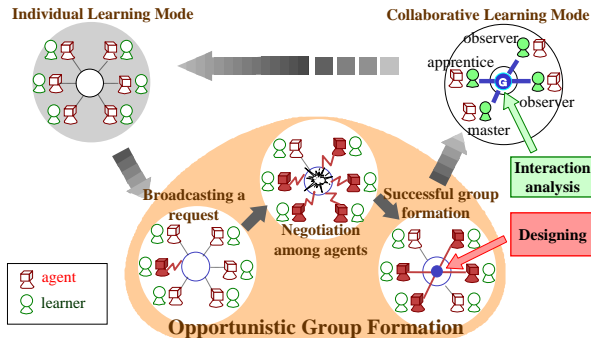


▲ Anderson, J. R. Acquisition of Cognitive Skill. In *Psychological Review*, 89(4), 1982, 369-406.
◆ Rumelhart, D.E., & Norman, D.A. Accretion, Tuning, and Restructuring: Three Modes of Learning. In *Semantic factors in cognition*. Hillsdale, NJ: Erlbaum, 1978, 37-53.

— [S(x,y)] — x: Stage of skill development y: Stage of knowledge acquisition

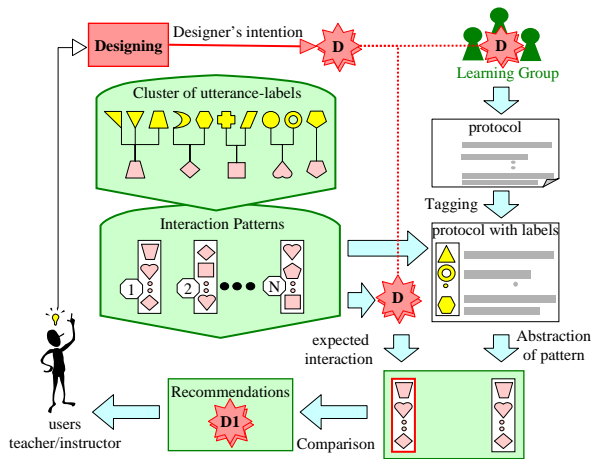
4) Applications

(4a) Group Formation

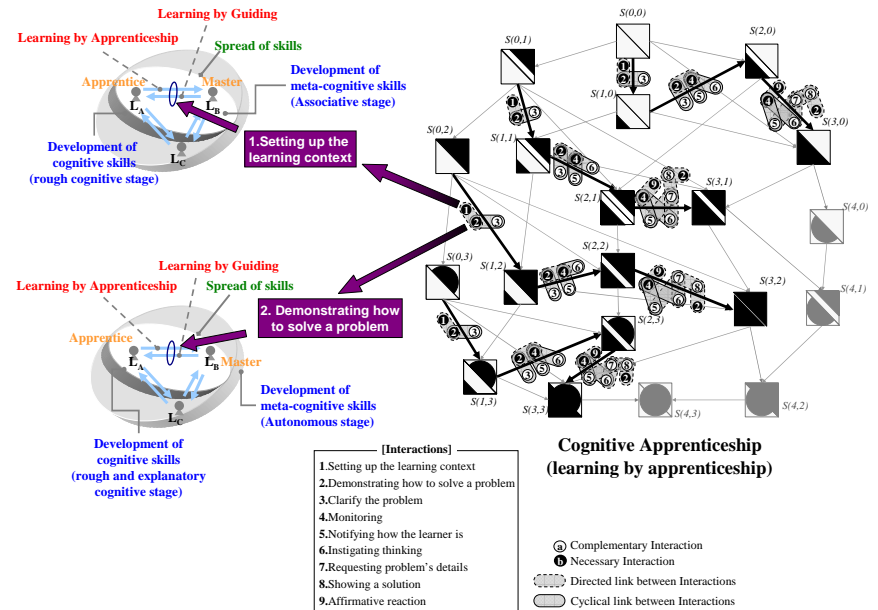


Ikeda, M., Go, S., Mizoguchi, R. A Model of Computer-Supported Collaborative Learning: Opportunistic Group Formation. In *Systems and Computers in Japan*, 30(8), 1999, 88-98.

(4b) Interaction Analysis



(4c) Design of Group Activities



5) Future Work

- To provide support and guidelines to blend learning strategies extracted from learning theories
- Online monitoring to evaluate group activities qualitatively and quantitatively (discovery of new patterns, dynamic design, etc.)
- Re-formation of groups based on effective interaction analysis and accumulation of knowledge