

**AUTOMATIC STRUCTURAL
KNOWLEDGE INTEGRATION IN
GROUP PROBLEM FORMULATION**

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Abstract

The study aims to design and evaluate a new IT artifact, Automatic Structural Knowledge Integration (ASKI), to enhance the effectiveness of the knowledge integration process in group problem formulation.

Structural knowledge describes how concepts within a domain are cognitively interrelated. It can be well represented by causal map, which is basically comprised of nodes and links to reflect cause-effect relations between concepts. Structural knowledge integration, an important type of knowledge integration, is defined as the synthesis of individuals' specialized structural knowledge into situation-specific systemic knowledge.

Prior research suggests that knowledge integration contributes mostly to organizational value creation. However, there is little research to detect its micro-level mechanisms from the cognition point of view. In this study we try to fill the gap by designing an IT artifact and evaluating its effect in the context of group problem formulation. Group problem formulation as a typical knowledge-intensive process relies heavily on the structural knowledge integration.

Following the philosophy of design science, the study consists of a design phase and an evaluation phase. In the design phase, the study reviews the current research on knowledge integration in group problem formulation. Then the study proposes the formalism of the ASKI based on Sowa's Cognitive Graph Theory and causal mapping techniques. Informed by ontology technology, the study also fine-tunes several algorithms to compute the semantic similarity among concepts to implement the ASKI. The final system, with ASKI-supported modules, is called the Ontology-based

Knowledge Integration System, which has the potential to be further developed to be a real commercial product.

In the evaluation phase, we refine the research questions into several hypotheses that can be empirically tested in experimental settings. The experiment design and measures are based on prior studies and a four-round pilot study. 144 business students in 36 groups participated in the main study. The results show strong support to the positive effect of ASKI on effectiveness of group problem formulation in terms of individuals' divergent and convergent thinking, as well as group's coverage of critical issues and consensus.

The study makes significant contributions to both the academic and industry fields. For academia, it is typical design science research, capturing both the technical and social aspects of information systems. From the knowledge engineering aspect, the study formalizes the causal map based structural knowledge integration and extends the field from syntactic integration to semantic integration. From the knowledge management point of view, the study not only evaluates the new IT artifact on individual and group performance, but also explains the cognitive impacts of knowledge integration. For industry, the ASKI prototype system can be used in practice and has the potential to be transformed to or integrated with commercial information systems. It presents important implications to the advancement of group support systems and organizational memory information systems.

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