Project Title: Keys to success for innovative ideation behavior: Ideation Trio
Research Thrust Area: New design paradigms and processes
Research Team: Seda Yilmaz (ID), Stephen Gilbert (IMSE), Debra Satterfield (GD)

Need and Industrial Relevance: “Innovation is more important than ever… That’s how we will ensure a high quality of life for this generation and future generations” Barack Obama, August 2009. Innovation is vital to our national competitiveness in a global economy. Engineering practitioners must design solutions for the global challenges of our world, and concept generation is critical to the success of the design outcomes. If engineering designers are able to have this skill, what we call “ideation flexibility,” they will be more suited to tackling diverse design challenges.

Project Goals: The goal of this research is to investigate how different factors impact design ideation as individuals and teams, and structure a new design framework supported with set of guidelines for the engineering faculty and practitioners. Our premise is that flexibility in ideation approach can be promoted by tailoring the way in which the design problem is presented/ framed, incorporating ideation tools into the ideation process, and leveraging one’s interactions with others during ideation.

Objectives: Based on the literature, we expect four key factors to influence ideation (figure 1): cognitive style, the framing of the design problem, concept generation tools, and interactions with others. The objective of this project is to gain fundamental knowledge about how these factors impact ideation, and learn how to leverage these factors in supporting ideation flexibility. By identifying how these factors influence ideation flexibility, we can better prepare engineers to meet the needs of 21st Century engineering.

![Figure 1. Four factors affecting ideation](image-url)
**Approach and Methods:** Our main research question is: How are approach and outcomes in ideation related to cognitive style, problem framing, use of concept generation techniques, and interaction with others? We will investigate the impact of these four factors on ideation in experimental studies with engineering and design college students, as well as practicing engineers and designers. We will investigate these relationships in one experimental context. Before the study, we will administer the KAI (cognitive style test). The study series will focus on individual ideation flexibility by investigating the effects on ideation behavior of problems framed in different ways, the use of an ideation tool called Design Heuristics, and the impact of engineers’ interactions as partners on ideation behavior. The diverse range of participants in our studies will allow us to investigate the effects of these factors on ideation in-depth, and in a comparative manner. The steps of the experimental study are listed in figure 2.

**Pre-session: Everyone takes KAI**

- Idea generation, individually - 15 min.
- Idea generation, with partners - 15 min.
- Idea generation, with Design Heuristics - 15 min.
- Selection of one idea for submission - 15 min.

**Figure 2. Sequence of tasks in the experiment**

**Outcome/Deliverables:** The outcomes of this project will yield a deeper understanding of how engineers with different cognitive styles at varying expertise levels approach design ideation. The findings will provide the basis of new instructional techniques and a set of guidelines to promote ideation flexibility, what we call the ‘Ideation Trio’ (Problem Framing Profile, Design Heuristics Guidelines, and the DYAD Guide) (figure 3).

**Impact:** The proposed effort will contribute significantly to the successful problem framing and solving that can be used by engineers at various expertise levels. Results of this effort will be integrated into the educational curriculum as lecture materials, to enrich the student learning experiences in design courses. Students introduced to the outcomes of our studies will be prepared for the challenges encountered by the differences in cognitive styles in their professional lives. Ideation Trio will be introduced to companies’ design departments as a series of ‘innovation workshops’. This will allow the practitioners to understand how their cognitive styles affect their ideation behavior, how they can frame problem in different ways, and how to apply design heuristics to generate creative solutions. The results of our work will be new,
empirically-driven set of guidelines applicable across design and engineering education and practice.

**Project Duration (plan and timeline):**

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<tr>
<th>Activity</th>
<th>2012</th>
<th>2013</th>
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<tr>
<td>Finalize IRB Approval</td>
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<td>Identify and recruit students and professionals</td>
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<td>Develop and Pilot series of design problems for different cognitive styles</td>
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<td>Data Collection</td>
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<td>Data Analysis</td>
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<td>Dissemination of Ideation Trio</td>
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**Proposed Budget:**
$42,000 for participant recruitment, graduate student for data collection and analysis, faculty time, travel to companies, publishing ideation trio for validation.