

Research on the Collaborative Design Taxonomy

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- Teams of individuals with different backgrounds (not just engineers) are often needed to effectively solve engineering design problems [1][2].
- A taxonomy for collaborative design was developed with the intent to be able to characterize collaborative design situations [3][4].
- The taxonomy was created in order to support a resistance based model of collaborative design [5].
 - The specific function of the collaborative design taxonomy is to identify certain activities that are modeled as resistances to the design process [5].

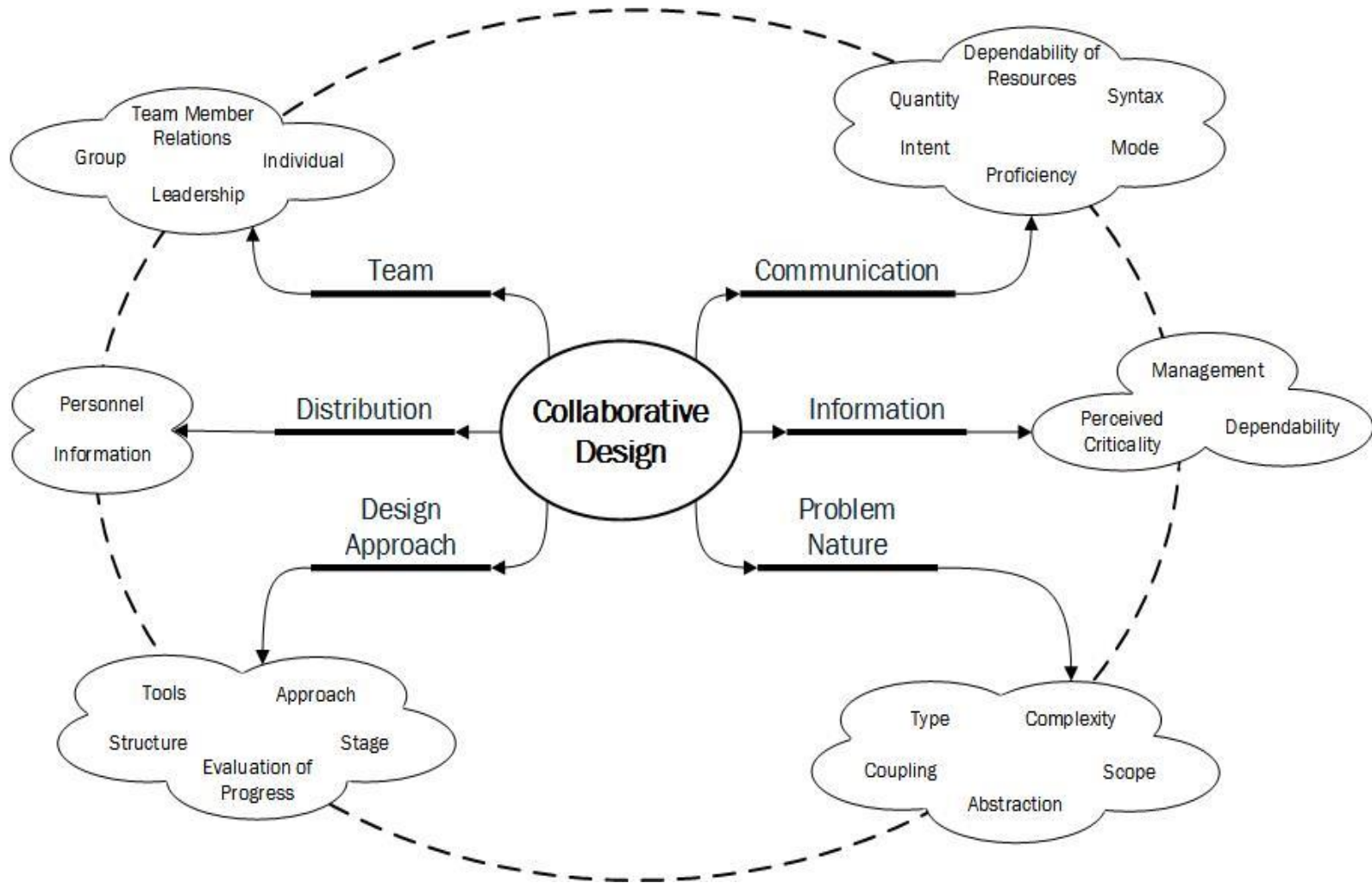


Figure 1 The collaborative design taxonomy [6].

- Create a more complete taxonomy that can be used in academia and industry in order to accurately characterize collaborative design activities
 - Identify potential areas of the taxonomy that require additional clarification and details.
 - Identify level 1 taxa that need to be restructured in order to be more effective.
 - Create a simple form of the taxonomy that can be used to characterized collaborative design research papers and teams.

- Three papers were chosen for individual review by four reviewers.
 - Two case studies & one experiment
 - Team size ranged from small sizes of 4-6 members to large multinational product teams
 - These papers were selected in order to determine the applicability and consistency of the matrix across a range of scenarios
- An inter-rater reliability test was performed to evaluate the agreement among reviewers.
- 21 additional sources were analyzed among the reviewers using this taxonomy.

- Taxonomy layer: Insufficient layers in some instances to characterize
 - Examples
 - Culture- Need for better definition
 - Complexity- Need for a metric
- Teams and Systems of Teams
- Temporal Aspects: duration of project; standing or task oriented project team
- Distribution: position in taxonomy
- Team vs. Activity
- Items not Commonly Characterized

- Team Composition
 - Expertise 95%
 - Size 86%
 - Leadership , personality, relations < 50%
- Distribution
 - Geographic 95%
- Nature of the Problem
 - Novelty 67%
 - Complexity- commonly addressed but little agreement

- Information
 - Form of transmission 33%
 - Management < 14%
- Communication
 - Mode 90%
 - Proficiency seldom addressed
- Design Approach
 - Design Stage most frequently addressed- 58%

- The Collaborative Design Taxonomy was an initial attempt to develop a means to characterize collaborative design activities.
- Taxonomy was applied to 24 research papers. Results showed:
 - 19 of 24 taxa were characterized less than 20% of the time: possibly these are not emphasized in literature or there is little research in these areas
 - Ambiguity in definition of terms may have resulted in not providing a characterization

There is a need to further develop the taxonomy to consistently and accurately apply it.

- **Apply taxonomy to undergraduate student design teams**
- Propose updated taxonomy
- Validate updated taxonomy

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Questions?

Table 2: Kappa Values for Each Pair of Raters (note that higher values indicate greater rater agreement)

	Rater Pairs					
Work Reviewed	1&2	1&3	1&4	2&3	2&4	3&4
[7]	0.609	0.524	0.697	0.652	0.696	0.653
[8]	0.661	0.704	0.601	0.670	0.380	0.413
[9]	0.697	0.697	0.650	0.827	0.777	0.633

- Results are acceptable according to Cohen's Kappa Scale [10]
 - Except for the 3 cells highlighted

Table 2: Three Initial Papers for Review to Determine Consistency and Rater Reliability

Reference	Title	Type of Study
[7]	An Observational Study on Functional Behavior in Team Design	Case Study
[8]	The Social Network among Engineering Design Teams and Their Creativity: A Case Study among Teams in Two Product Development Programs	Case Study
[9]	An Experimental Study of Group Idea Generation Techniques: Understanding the Roles of Idea Representation and Viewing Methods	User Study

Table 3: Papers Evaluated to Determine Frequency of Each Taxonomy Category Discussed

Reference	Title	Method
[11]	An organizational view of design communication in design collaboration	Case Study
[12]	Observations of Teamwork and Social Processes in Design	Protocol Study
[13]	Multidisciplinary Team-Based Project Work: Planning Factors	Case Study
[14]	Characterization of Collaborative Design and Interactive Management Activities in a Distant Engineering Design	Protocol Study
[15]	Study of the Efficiency of Product Development Teams Through Combined Virtual Communities of Practice	Case Study
[16]	Information Behavior in Multidisciplinary Design Teams	Protocol Study
[17]	Comparing Graphic Actions Between Remote and Proximal Design Teams	User Study
[18]	A Method to Study Affective Dynamics and Performance in Engineering Design Teams	Protocol Study
[19]	Design Teamwork in Distributed Cross-Cultural Teams	Case Study
[20]	A Protocol for Connective Complexity Tracking in the Engineering Design Process	Case Study
[21]	Investigation of Internal and External Design Teams During the Product Development Process in Footwear	Case Study

Table 3 (cont.): Papers Evaluated to Determine Frequency of Each Taxonomy Category Discussed

Reference	Title	Method
[22]	Pragmatic Team Compositions in Scrum-Based Development Project	Case Study
[23]	Characterization of Leadership with Undergraduate Design Teams through Case Study Analysis	Case Study
[24]	Communication Roles that Support Collaboration During the Design Process	Case Study
[25]	Analysis of Team Communication	Protocol Study
[26]	A Longitudinal Study of Globally Distributed Design Teams: The Impacts on Product Development	Case Study
[27]	Case Study: Application of Team Based Learning to a Mechanical Engineering Design Course Traditionally Taught in Lecture Format	Case Study
[28]	Training for Reflective Competency in Design Teams: An Empirical Study	Case Study
[29]	Culture and Concept Design: A Study of International Teams	Case Study
[30]	The Analysis of Knowledge Integration in Collaborative	Protocol Study