Computer Science, Faculty of Science

Exploring Communicative Acts in Diverse Software Engineering Student Teams

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Motivation

Team-based activities are central to collaborative learning. Research on diverse professional software engineering teams shows gender diversity has a positive impact on team effectiveness. Recent works also reveal that benefits of diverse professional teams do not necessarily carry through in educational settings. We explore the dynamics of diversity in software engineering student teams.

Software Collaboration Process

Teams collaborate on a GitHub repository:

- The stable master version remains online
- Members *pull* from master to develop code locally
- Members *push* completed changes to repository and make a *merge request* to have their code reviewed by other members
- Two members act as reviewers and evaluate the new code quality
- Reviewers may ask for clarifications on the new code, discuss alternate approaches to the work, or request changes from the author
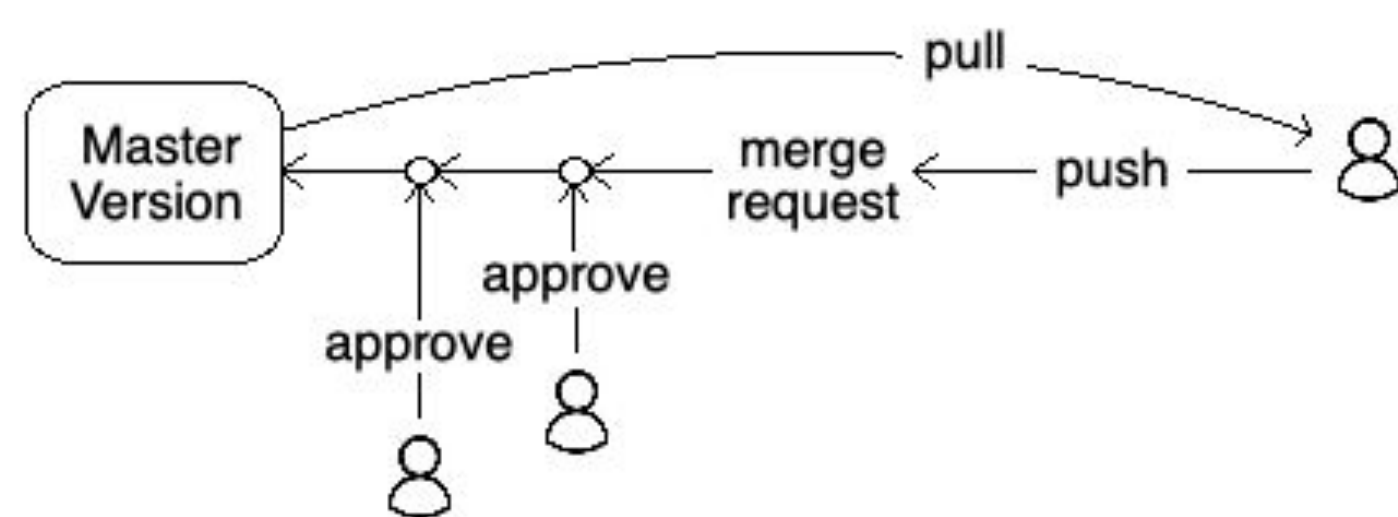

Categorization-Elaboration Model (CEM)

CEM (van Knippenberg & van Ginkel, 2010) explains the relationship between diversity and performance using:

- **Social categorization:** The process by which people categorize themselves and others into differentiated groups
- **Group information elaboration:** The exchange, discussion, and integration of task-relevant information and perspectives

Information elaboration serves as a core process, with other mediating factors:
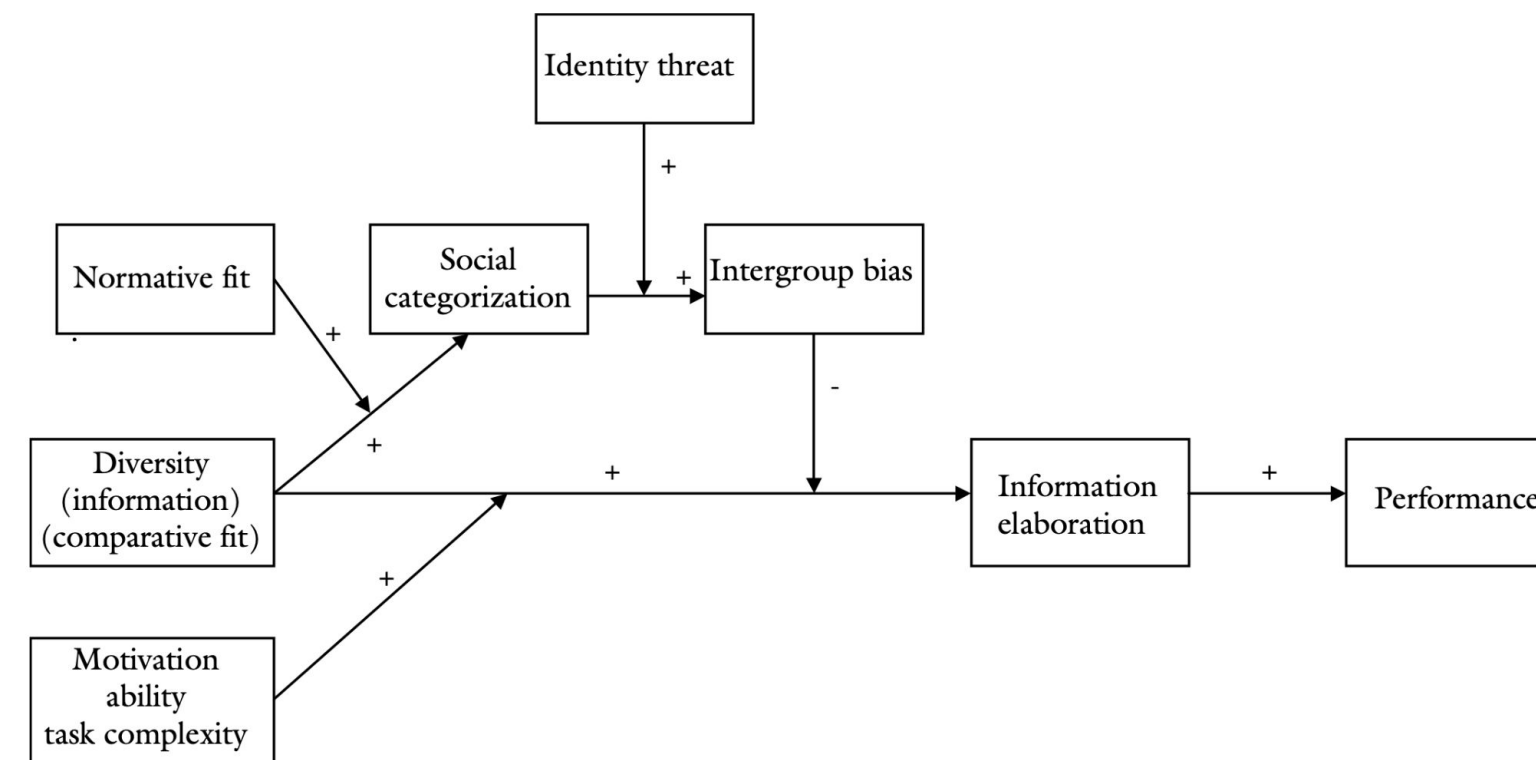
Intragroup Conflict

Conflict theory (Jehn, 1995) suggests two types of conflicts within groups:

- **Relationship conflict:** Issues related to interpersonal differences in values
- **Task conflict:** Issues related to differences in the work approach

Communication can be viewed as a mechanism to resolve conflict and minimize intergroup bias to arrive at positive performance outcomes.

Study Context

Undergraduate senior Computer Science software engineering class with 105 students split into 22 teams:

- 4,803 comments (average 218 comments per team, between 40 and 1,328 comments)
- Content analysis by two raters on 30% of data (one round of inductive familiarization, two rounds of deductive categorization, intercoder reliability α = 0.856)

The non-parametric Mann-Whitney U-test showed a statistically significant difference between **gender-homogeneous teams** (all males, red) that demonstrate predominantly task-oriented communication (e.g., contextual approval, updating, expressing opinions, complementing) from **gender-diverse teams** (blue) that engage in social relational communication (e.g., emoting, complementing) and less task-oriented acts (e.g., shallow approval, criticizing) (U = 109, p < 0.001).
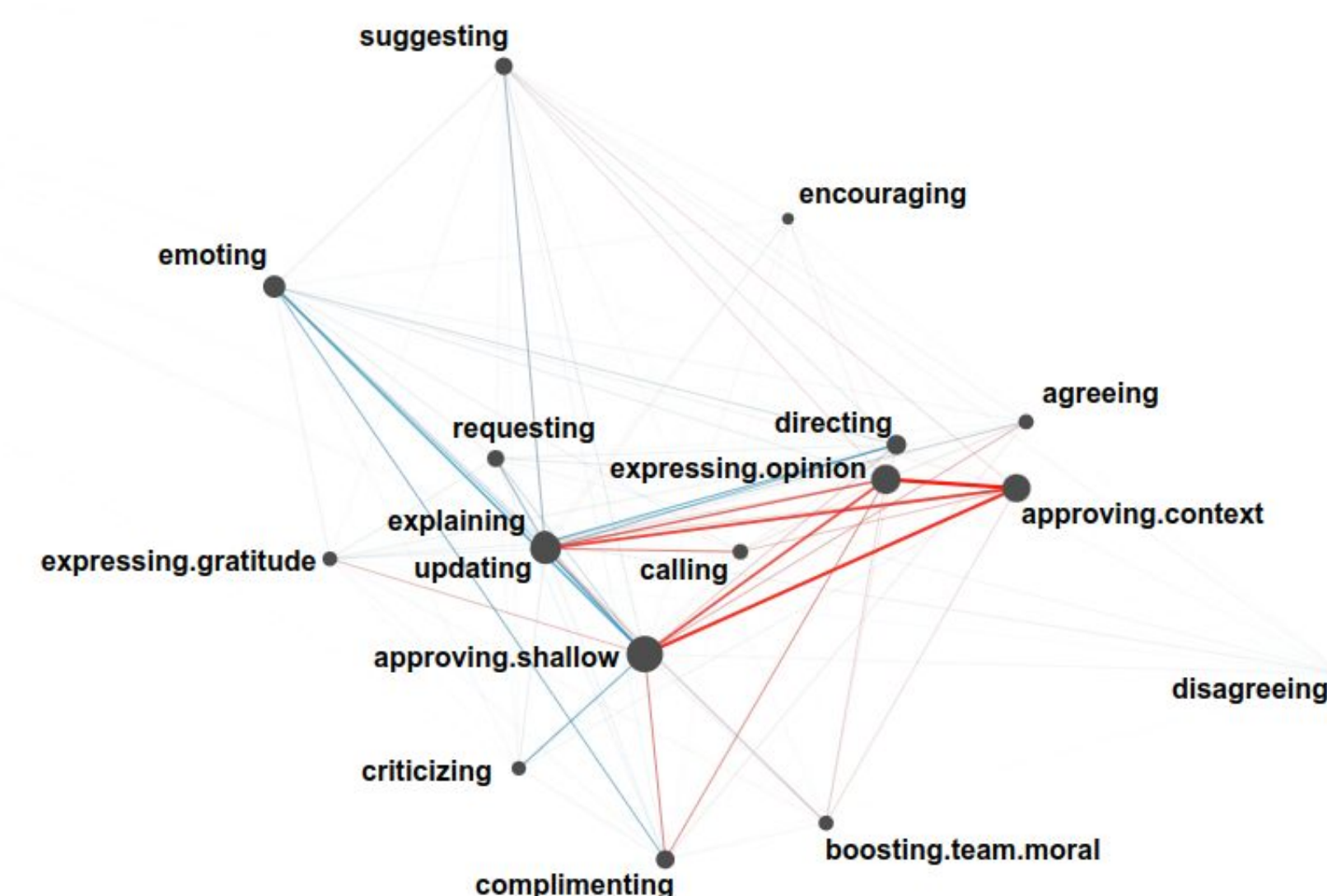
No statistical significance was found for **racially diverse** and **racially homogeneous** teams.

Teams with **intersectional members** (gender and race) showed similar communication patterns as gender-diverse teams (U = 102, p < 0.001).

High-performing teams exhibit behavior for strong encouragement, detailed explanations, and context-rich communication (e.g., explaining, expressing opinions, complementing), which is statistically significantly different from **low-performing teams** (e.g., shallow approvals, directing, updating) (U = 103, p < 0.001).

Combinations of gender, race, and performance show similar patterns as above.

Notably, the specific combination of **low-performing gender-diverse teams** (blue) display an increase in helpful collaboration (e.g., suggesting) in contrast to **high-performing gender-diverse teams** (red) – a pattern not seen with gender or performance alone (U = 29, p < 0.05).