Relationships Between Team Communication Behaviors and Problem-Solving Confidence

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ABSTRACT

This study examined communication behaviors in Software Engineering team meetings to understand how efficiency, sentiment, and agreement relate to students' problem-solving confidence. Audio recordings and end-of-semester surveys were collected from six development teams (21 students total). Audio transcripts were coded for problem statements, solution proposals, "OK" agreement markers, and sentiment polarity. Survey data measured confidence, collaboration, commitment, and effectiveness using 5-point Likert scales. After cleaning and merging the datasets, analyses using Python, JASP, and Excel showed that efficiency and agreement behaviors strongly predicted positive sentiment at the individual level. At the team level, a combined regression model revealed that collaboration and communication efficiency together explained most of the variance in confidence.

INTRODUCTION

- **Stakeholder:** Software Engineering course instructor seeking early indicators of struggling teams
- **Motivation:** Enable instructors to monitor team health and provide timely coaching using automated analytics
- **Origin of Question:** Stakeholder interviews emphasized a need to identify teams losing confidence before performance declines
- **Why It Matters:** Early detection supports intervention, improves project outcomes, and enhances teamwork
- **Research Question:** Are team communication behaviors (efficiency, sentiment, agreement) related to problem-solving confidence?
- **Long-Term Goal:** Use results to guide development of an automated prototype assessment tool integrating audio + survey analytics for real-time team monitoring

OUTCOMES

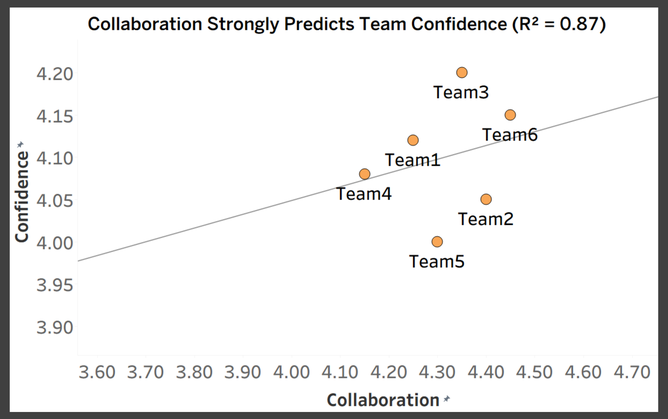
How Do Collaboration and Efficiency Together Predict Team Confidence? (By teams, n = 6, audio + survey data combined)

- Multiple regression was conducted to predict Team Confidence from Team Collaboration and Team Efficiency.
- The regression model was statistically significant, $F(2,3) = 9.92$, $p = 0.045$, $R^2 = 0.87$, explaining 87% of the variance in team confidence.
- In the regression model, Collaboration statistically predicted Confidence ($\beta = 0.72$, $t(3) = 3.84$, $p = 0.03$).
- Efficiency showed a positive relationship but was not statistically significant in the regression model ($\beta = 0.21$, $t(3) = 0.98$, $p = 0.39$).

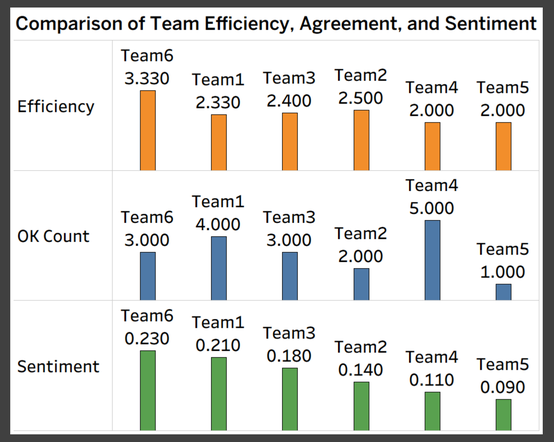
Correlations (reported after regression):

- $r = 0.847$, $p = 0.034$ → Collaboration × Confidence
- $r = 0.320$, $p = 0.538$ → Efficiency × Confidence

Interpretation: Team collaboration is a very strong predictor of self-reported confidence, combining survey perception with audio efficiency yields strong explanatory power, though the team sample is small.



The scatter plot above displays Collaboration (X-axis) and Confidence (Y-axis), with a regression line showing the strong positive relationship. Teams with higher collaboration report higher confidence.



The bar chart above shows Efficiency, OK Count, and Sentiment for each team. Teams with higher efficiency also displayed higher positive sentiment.

Are Team Efficiency, OK Count, and Sentiment Related? (By teams, n = 6, audio data aggregated to team level)

- Multiple regression was conducted to predict Team Sentiment from Team Efficiency and OK Count
- The model was statistically significant and explained 79.2% of the variance in sentiment ($R^2 = 0.792$), $F(2,3) = 5.72$, $p = 0.046$
- Efficiency significantly predicted Sentiment ($\beta = 0.619$, $t(3) = 2.94$, $p = 0.042$)
- OK Count positively predicted Sentiment but was not statistically significant ($\beta = 0.381$, $t(3) = 1.81$, $p = 0.138$)

Correlations (reported after regression):

- $r = 0.756$, $p = 0.028$ → Efficiency × Sentiment
- $r = 0.588$, $p = 0.116$ → OK Count × Sentiment

Interpretation: Teams that were more efficient (proposed more solutions relative to problems) showed significantly more positive sentiment. Agreement (OK count) showed a positive relationship but was not statistically significant in this sample.

DATA DESCRIPTION

Sample:

- Participants enrolled in an undergraduate software engineering course
- 4 teams from 2024 and 2 teams from 2025
- 21 individual students across 6 teams

Key Derived Variables:

- Efficiency = Solutions_Count ÷ Problems_Count
- OK_Count = count of "ok" per participant or team
- Sentiment = mean ChatGPT sentiment score per utterance (range –1 to +1)
- Confidence, Collaboration, Commitment, Effectiveness = survey means

CONCLUSIONS

- Efficiency and OK_Count predict more positive Sentiment at the individual level
- Collaboration is the strongest survey predictor of Confidence
- Combined audio + survey regression model explained a large portion of variance in Confidence ($R^2 = 0.87$)
- Findings support the development of an automated assessment prototype tool to assist instructors in monitoring and providing early team intervention

REFERENCE

- Lencioni, P. (2002). The Five Dysfunctions of a Team

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