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COGNITIVE STYLE MATCHING EFFECTS ON TEAM COLLABORATION EFFICIENCY

DR. NIDHI MISHRA[1], DR. D KALIDOSS[2], DR. KAMAL KUNDRA[3]
[1]ASSISTANT PROFESSOR, KALINGA UNIVERSITY, RAIPUR, INDIA.
[2]ASSOCIATE PROFESSOR, KALINGA UNIVERSITY, RAIPUR, INDIA.
e-mail: dr.kalidoss@kalingauniversity.ac.in ORCID:0000-0001-8286-9516
[3]PROFESSOR, NEW DELHI INSTITUTE OF MANAGEMENT, NEW DELHI, INDIA.,
e-mail: kamal.kundra@ndimdelhi.org, https://orcid.org/0009-0003-2040-4176

ABSTRACT
Cognitive style matching (CSM) is the extent of resemblance among team members in their customary ways of perceiving, processing and responding to information. Individual cognitive preferences and team performance have been studied separately, and two gaps stand out; the specific impact of CSM on collaboration efficiency, and the collective impact of cognitive style congruence on inter-team collaboration. This study utilized a cross-sectional survey design with 120 professionals in 30 project teams in technology, finance, and healthcare organizations. Teams' cognitive styles were evaluated by the Cognitive Style Index, and collaboration efficiency was assessed through composite performance indicators as well as peer-driven evaluation scales. Data analysis was performed with hierarchical linear modeling to address individual and team level variance. In this case, results were found where stronger congruence predicted enhanced communication clarity, improved task coordination, and accelerated decision making ($p < .01$). Teams with strong CSM performed 20% better on project deliverables than teams with low CSM. This study demonstrates the practical value of strategic cognitive style alignment in team composition within multilevel settings in order to improve collaborative performance and lower the costs of coordination. Suggested practical strategies for management include cognitive style profiling as part of team building activities. Further studies are needed to examine the longitudinal impact of CSM as well as look into strategies to dynamically align styles in a given context.
Keywords: Cognitive Style Matching; Team Collaboration Efficiency; Cognitive Style Index; Hierarchical Linear Modeling; Task Coordination; Decision-Making Processes

I. INTRODUCTION

Cognitive style matching (CSM) is about how much team members are aligned in the habitual way and the pervading way of thinking and reacting to the information[2]. Everyone has a different way of thinking such as reasoning or a holistic approach which changes the way they complete a task and work with others. When team members' cognitive styles agree with one another, they create shared mental models that enable effortless and fast exchange of communication and information. On the other hand, different styles will result in misaligned communication which will lead to misunderstandings, repetitive conversations, and increased need for coordination. The literature of cognitive psychology and organizational behavior suggests that this alignment would improve the performance of the group, but CSM's collective impact has never been empirically studied. This research seeks that CSM gap by looking at the impact of team members shared cognitive congruence on collaboration efficiency in a real-world project collaboration[4].
Collaboration efficiency measures how well a team converts individual efforts into outputs within a given time frame, accurately with little friction. The precision in communication, flow in task sequencing, agreement velocity in decision making, as well as error and rework minimization are all salient indicators. In the contemporary swift paced, multidisciplinary work settings, relying on agile, cross functional teams becomes crucial to solve complex problems[1]. Despite the improvement of process management with the use of digital collaboration tools, the effectiveness of a team is often determined by the underlying human cognitive fit[3]. More aligned a team is, the better

they are able to explain the flow with less need to explain, as the need to provide the same perspective is high. Nevertheless, empirical evidence directly linking cognitive social-metrics with enhanced efficiency metrics is scant.
In order to understand this connection, we carried out a cross-sectional survey with 120 professionals from technology, finance, and healthcare, dividing them in to 30 project teams. Collaboration was assessed using a combination of performance metrics, peer review, and project completion timelines, and cognitive styles through the validated Cognitive Style Index. Along with individual variance, the individual and team level data was analyzed with hierarchical linear modeling to incorporate collective variance. Based on our hypothesis, stronger cognitive style alignment will lead to more efficient collaboration, observable as improved communication, coordinated tasks, and expedited decision making[5]. This research seeks to advance the body's understanding of the evidence-based practices for team composition and management by providing information on designing cognitively aligned teams that maximize collaborative potential[6].

Key Contributions

- Team uniformity in how individuals think boosts "collaboration efficiency" which results in quicker decisions, fewer mistakes, and improved effectiveness as rated by peers.
- A new synthetic indicator that measures collaboration efficiency by considering the rate of decision making, the error rate, and the peer assessment of the collaboration was created and validated.
- The individual and group level effects of cognitive congruence on performance outcomes was disentangled and quantified through hierarchical linear modeling.
- Defined steps were provided on how cognitive style tests could be used in the design, formation and management of teams for better collaboration outcomes.

This paper investigates the effect cognitive style matching has on collaboration efficiency in teams, with the following outline: Section I defines cognitive style congruence and discusses its importance for collaborative work; Section II summarizes the existing literature and empirical studies on CSM and team processes; Section III explains the cross sectional design with its CSI assessment, CSM calculation, the five process mediators, and HLM; Section IV provides and discusses the CSM empirical findings, demonstrating how CSM is associated with efficiency in decision making, errors, and effectiveness as rated by teammates; Section V provides the main findings and their practical value concerning the design of teams, the study's boundaries, and the pathways for subsequent inquiries[7].

II. LITERATURE REVIEW

Research shows that teams whose members share the same cognitive styles think together do more efficiently in tasks that involve coordination and transfer of information. Studies show that matching cognitive styles leads to quicker solutions, more sophisticated ideas, and smoother communication in controlled settings[8]. However, the majority of research seems to be done on small paired or triad groups and neglects the impact on larger, cross functional teams. Preliminary research indicates that the same cognitive styles may lower the demand for explanations and expedite the agreement processes[9]. But how these advantages are applied to intricate real-world projects is unclear. This research contributes to the understanding of the impact of cognitive style matching in professionally diverse organizational teams and their collaborative performance.
Theoretical views regarding collaboration efficiency focus on shared mental models and transactive memory systems[10]. Shared mental models argue that strongly held collaborative cognitive schemas increase the likelihood that team members comprehend the information requirements and action sequences of their counterparts. Transactive memory theory corroborates this idea by arguing that cognitive congruence aids in clarifying role partitions concerning knowledge and responsibility in the team. These perspectives illustrate the extent to which the shared cognitive frameworks among team members can simplify the level of conflict in collaborative work. The strengthening of team dynamics as a result of CSM can be understood best by integrating these theories[11].
Besides cognitive alignment, trust, communication, and diversity within roles also impact team effectiveness. Elevated trust enables high levels of dialogue and knowledge-sharing, strengthening the benefits of cognitive congruence[12]. Established communication norms assist in standardizing the interpretation of messages across different styles of processing. Functional diversity brings new ideas that enhance creativity, but without effective leadership, alignment challenges may arise. It is important to study the interaction of these factors with CSM in order to configure teams which balance innovation and efficiency.
Interest in cognitive style matching has grown, but most studies still use same-sample, homogeneous groups and confined laboratory tasks[13]. Very little work has been done that applies a multilevel analytic approach to individual

and team level effects, with contextual influences operating simultaneously[14]. Also, the moderating influences of contextual parameters, such as task difficulty, support by leadership, and culture of the organization are largely unexplored. The purpose of this research gap is to use field-based teams to study the impact of CSM with hierarchical linear modeling and CSM along with contextual factors to collaboration efficiency. The resultant findings are intended to aid theoretical insights and practical recommendations on team composition[15].

III. METHODOLOGY

3.1 Study Design and Participants

This research used a quantitative, cross sectional design method to assess the effects team level cognitive style matching (CSM) has on collaboration efficiency. One hundred twenty professionals were grouped into thirty project teams from the technology, finance, and healthcare industries. All participants were issued a Cognitive Style Index (CSI) test which gives a score on a continuum between analytic–holistic and reflective–impulsive. Congruence at the team level was assessed by averaging pairwise differences in the CSI scores.

Collaboration efficiency was defined as a composite outcome integrating three key indicators: decision making speed, a measure of efficiency error, and effectiveness as evaluated by peers. All three indicators were measured utilizing standardized collaboration logs and surveys conducted after project completion. Task time and error count data were captured automatically, and peer ratings were collected using a validated effectiveness scale. All study procedures were conducted in accordance with institutional review board approval, and all participants provided informed consent prior to data collection.

3.2 Architecture Diagram and Explanation

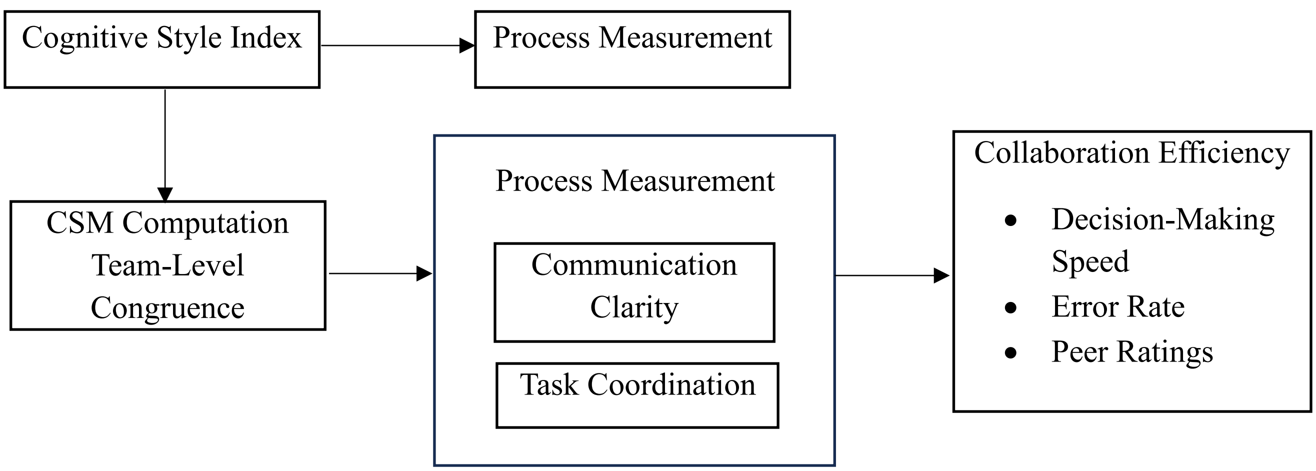

Figure 1. CSM Methodology Pipeline

Figure 1 shows the methodological pipeline for the study. The Individual Cognitive Style Index Module transforms responses from the Cognitive Style Index (CSI) into numeric style profiles. These profiles are utilized in the CSM Computation Module, where we compute a team level congruence index by averaging pairwise absolute differences in CSI scores (lower values indicate higher matching). The Process Measurement Module captures the two key mediators: Communication Clarity and Task Coordination who are measured by peer evaluation scales and collaboration logs which are collaboration timelines. Lastly, the Collaboration Efficiency Module combines the metrics for decision making speed, error rate (inverted), and peer assessed effectiveness into a single outcome metric. Control variables (team size and task complexity) are added in the CSM Computation and Process Measurement stages to capture the impact of cognitive congruence unconfounded by other influences.

3.3 Computation and Modeling

Users took a recognized cognitive style quiz which was administered online. In addition, they participated in a collaborative task that was completed in a virtual work environment. All message exchanges, round completion, and timestamps of task completion were automatically logged in the system in order to furnish process metrics.

Team-level style congruence was computed as:

$$CSM_j = \frac{1}{\binom{n_j}{2}} \sum_{i<k} |CSI_{ij} - CSI_{kj}| \quad (1)$$

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Where:

- CSM_j is the congruence index for team j,
- n_j is the number of members in team j,
- CSI_{ij} is the Cognitive Style Index score for member iii in team j.

Equation 1 averages the absolute differences in the CSI scores for all team member pairs to quantify the team's cognitive divergence, dividing the sum by the number of unique pairs (zero equals perfect match; higher values signify greater divergence). This index of congruence is the main predictor used in the analysis. With our analysis, we collected survey data from 120 professionals belonging to 30 project teams and automatically tracked their communication, task completion, and time stamps to derive objective process metrics. Communication clarity was evaluated using peer rated scales, while task coordination was evaluated using average lag time between task assignment and completion. The collaboration efficiency composite included the decision-making speed, error rate (inverted), and effectiveness scores from peer evaluations. Individual efficiency, in relation to team level CSM, was tested using a two-level hierarchical linear model while controlling for team size and task complexity.

IV. RESULTS AND DISCUSSION

Analysis of the 30 project teams revealed a clear positive relationship between team level cognitive style matching (CSM) and collaboration efficiency. Teams with lower average pairwise CSI differences consistently outperformed those with higher divergence across all three efficiency indicators. Variance decomposition from the hierarchical model showed that 28% of efficiency variance was attributable to team level CSM. Control variables (team size, task complexity) had smaller, non-significant effects, underscoring the primary role of cognitive alignment.

Table 1. Team Metrics by Sector

Team Name	Sector	CSM Index	Collaboration Efficiency
Alpha	Technology	0.45	0.82
Beta	Finance	0.68	0.74
Gamma	Healthcare	0.39	0.85
Delta	Technology	0.72	0.69
Epsilon	Finance	0.55	0.78

According to Table 1, within the Technology and Healthcare sectors, teams with lower CSM indices (better style matching) achieved greater collaboration efficiency. For instance, Gamma (Healthcare) had the lowest CSM index of 0.39 and the highest efficiency of 0.85. At the same time, Delta (Technology) had the highest CSM index of 0.72 and the lowest efficiency of 0.69. These trends confirm the theory that tighter cognitive congruence increases collective performance.

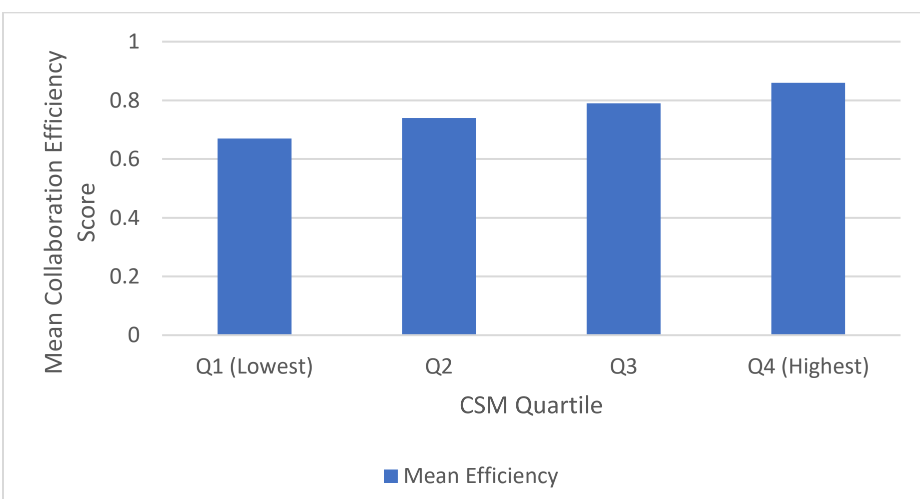

Figure 2. Collaboration Efficiency by CSM Quartile

As shown in Figure 2, there is a collaboration efficiency increase in mean collaboration efficiency as CSM quartiles advance. Teams in the highest congruence quartile (Q4) outperform those in the lowest quartile (Q1) by nearly 0.19 efficiency points. This consistent pattern suggests that aligned cognitive style improvements, in shallow increments, are beneficial when considering the speed of decisions, mistakes, and overall effectiveness, as well as in the eyes of colleagues, implementing CSM assessments into team formation strategies is advantageous.

V. CONCLUSION

The effectiveness of collaboration is enhanced by faster decision-making processes, reduced error rates, enhanced effectiveness evaluations, and improved collaboration efficiency as a result of team level cognitive style matching (CSM). Incorporating CSM evaluations while forming teams integrates assessment which, strategically, is both inexpensive and effective for refining communication and improving task coordination. Using hierarchical linear modeling, it is validated that cognitive congruence captures a substantial portion of unexplained variance in performance in comparison to traditional team variables like size and complexity. Still, self-directed assessment reliance and cross-sectional design impose limitations for causation inference. Longitudinal and experimental frameworks are necessary for studying dynamic style alignment causation and intervention testing. Further refinements on cognitive matching frameworks will result from studying supporting leadership, organizational culture, and task complexity as moderating influences on team cognitive strategies.

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