

# Creativity In A Cognitive Diverse Team: The Roles Of Design Thinking And Learning Orientation

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## **Abstract:**

**Background:** Applying a motivational and cognitive approach to creativity, the authors hypothesized how (through the mediation effect of design thinking) and when (under the moderation effect of learning goal orientation), the perceived cognitive diversity at workplace is linked to creativity. The current study makes a broader contribution by exploring the proposed relations at both the group and individual levels.

**Materials and Methods:** To examine the hypotheses, a quantitative method was applied. The data was accumulated from the study sample of 150 supervisor-employee sets, consisting of 10 workgroups.

**Results:** According to the research findings, at both the group and individual levels, learning goal orientation has a significant impact on the positive relationship between design thinking and perceived cognitive diversity in such a way that the direct link is stronger at higher levels of learning goal orientation. Additionally, the results identified that learning goal orientation moderates the mediating linkage between creativity and perceived cognitive diversity via design thinking.

**Conclusion:** learning goal orientation has a significant impact on the positive relationship between design thinking and perceived cognitive diversity

**Key Word:** Cognitive diversity; Design thinking; learning goal orientation;

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## **I. Introduction**

Creativity, defined as the generation of novel and useful ideas (Amabile, 1996), can enhance firm competitiveness under the right conditions (Kim, 2020). As diverse teams are usually assembled to produce creative ideas, (Van Knippenberg, De Dreu, & Homan, 2004) and cognitive team diversity (i.e., diversity among team members in terms of thinking, knowledge, skills, world views, and beliefs, (Kim, 2020; Petrou, van der Linden, Mainemelis, & Salcescu, 2020) provides diverse cognitive resources for generating creative ideas, interest in the role of cognitive team diversity in creativity has been growing (Chen, Feng, Liu, & Yao, 2021; JISEON SHIN, M. SUSAN TAYLOR, & MYEONG, 2012). Extant research suggests that cognitive team diversity can enhance creativity, especially when transformational leadership and team perspective-taking are high (Hoever, Knippenberg, Ginkel, & Barkema, 2012; Shin, Kim, Lee, & Bian, 2012). Many studies suggest that cognitive diversity brings a positive element to group performance and it leads to team creativity and improved quality of decision-making (e.g. Vaezipour, 2014). with research findings suggesting that cognitive diverse teams have a lot of potential in terms of creativity. However, diverse teams may not outperform homogenous ones on overall solution quality because heterogeneity can hurt group interaction (Hayo & Volla, 2012). People with similar attributes are likely to categorize themselves into the same category, and tend to get along with each other. Getting along is a beneficial factor to group process, and group homogeneity contributes to group interaction by building higher levels of cohesion (Williams & O'Reilly III, 1998) and reducing intense arguments associated with less conflict (Cho, Hambrick, & Chen, 1994).

Despite the valuable insights generated by prior research, several theoretical voids remain. First, few studies have theorized and examined how cognitive team diversity influences creativity (see Shin et al., 2012 and Wang et al., 2016 for exceptions). Cognitive team diversity implies potential cognitive resources; thus, extant research has unsurprisingly focused on cognitive mechanisms such as the elaboration of task information (Hoever et al., 2012; Kearney & Gebert, 2009). However, design thinking has not been a dominant perspective in the creativity literature (Amabile, 1996) as well as research linking context and creativity has paid little attention to examining design thinking as a mechanism. In a recent exception, Wang et al. (2016) found that cognitive team diversity and transformational leadership interactively affected design thinking and team creativity. This lack of research is problematic because the explanatory power of the design thinking perspective remains questionable without such direct examinations. The diversity literature (e.g., Jackson et al., 2003) also suggests that motivational mechanism is potentially important as well. Unlike demographic diversity (e.g., sex and race) that specifically highlights identity differences and often engenders negative motivation based on social categorization

(Tajfel & Turner, 1986), cognitive team diversity features diverse ideas and perspectives that are potentially relevant to design thinking (i.e., a positive motivational and cognitive mechanism). In addition, the extant research on cognitive team diversity and creativity has examined creativity at a single level with a major focus on team creativity (with the exception of Richter et al., 2012 and Shin et al., 2012 whose studies are focused on individual creativity).

Creativity research has generally adopted cognitive and motivational approaches in a parallel fashion. These variables act as boundary conditions for the cognitive approach and provide a potential explanation for the prior mixed findings (e.g., Pieterse et al., 2011; Shin et al., 2012).

Thus integration of different approaches represents a promising research direction (Zhou & Shalley, 2011). Specific to cognitive team diversity, some scholars have examined cognition-related moderators, such as team perspective-taking (i.e., a cognitive process involving the understanding or consideration of other viewpoints; Hoever et al., 2012) and creative self-efficacy (i.e., the self-belief about one's capability to be creative; Shin et al., 2012). However, only a few studies have investigated motivational moderators. This omission is problematic because creativity is the outcome of the interplay between cognitive and motivational variables (Mumford & Gustafson, 1988).

There interesting research questions arise: (1) Does cognitive team diversity similarly influence team creativity and individual creativity? (2) Does design thinking link the relationship between cognitive diversity and team creativity? and (3) Does goal learning orientation moderate the indirect relationship between cognitive diversity and team creativity via design thinking? Questions concerning the multilevel generalization theory (i.e., whether the same antecedent similarly influences creativity at different levels and whether the same mechanism holds at different levels) have received limited attention in creativity research (Zhou & Shalley, 2011). Therefore, our first goal is to ascertain whether design thinking mediates the relationship between cognitive team diversity and both individual and team creativity. We focus on perceived cognitive diversity because perceptions have the most direct bearing on motivational and behavioral reactions in teams (Harrison et al., 2002) and also play an important role in team creativity dynamics (Shin et al., 2012). In this study, we adopt a motivational perspective as well as cognitive perspective by examining learning goal orientation (i.e., the extent to which a team or an individual emphasizes learning and competence development; Bunderson & Sutcliffe, 2003; Gong, et al., 2013b) as a moderating variable that enhances the effects of cognitive team diversity on creativity as well as design thinking as a mediating variable. When team members strongly share a goal of learning, they are more likely to enjoy working with people who have different ways of thinking, thus increasing team design thinking.

Our study extends the current research on diversity and creativity in several important ways. First, we advance extant research on cognitive team diversity and creativity by not only adding design thinking as a mediating mechanism to link cognitive team diversity and creativity but also by revealing a positive motivational and cognitive mechanism that goes beyond the negative ones predicted by social categorization processes in the diversity literature. Second, we advance multilevel theory and research on creativity by examining whether the design thinking mechanism operates similarly in linking cognitive team diversity with both team and individual creativity. In addition, we integrate cognitive and motivational approaches into creativity by examining the interplay between cognitive team diversity and learning goal orientation. The integration of the two approaches can advance our understanding of creativity beyond what each approach can do alone. Finally, as Zhou and Shalley (2011) suggested, a direction for future research is to test cross-national generalizability of the findings in the creativity-at-work literature. Research shows that Kenyan employees tend to express different views at work picciano2017even more than do other Africans as well as Asians such as Tanzania and South Koreans (Onishi & Bliss, 2006); accordingly, it is possible that the effects of perceived cognitive diversity on creativity as well as design thinking in Kenya may be somewhat different from Wang et al.'s 2016, Wei & Li, 2013) findings in South Korea. Thus, this research may contribute to the cognitive diversity and creativity literatures by examining the effects of perceived cognitive diversity on creativity via design thinking in the Kenyan context.

## **II. Theory And Hypothesis Development-Goal Learning Theory**

The practice of DT in organizations focus in the theory of constructivism pande,bharathi,2020. Constructivism focuses on the process by which individuals build their own mental structures from an interaction between their experiences and ideas (Piaget, 2020). This theory favours hands on, task –oriented, self- directed activities aimed to design and discovery picciano,2017. Design thinking Encourages empathy, experimentation, curiosity, courage, open-mindedness, holistic thinking, stripping away biases, and favouring ambiguity over rational clarity reiter-palmon&Royston,2017. Design Thinking as per kress &schar,2012, help to choose and select team members for a given Design Thinking work project. Some of the questions to ask include: Which team members already possess these characteristics? Who would be open to them as well as which team members possess the core expert skills required. However this should not prevent less experienced individuals from sharing ideas, and putting forward alternative ways of seeing things. This illustrates how design-innovation differs significantly from processes used in traditional business or corporate settings Reiter-palmon & leone,2019.

An organization may be tempted to go with decisions and act in regard to what had worked in the past (Shin, Kim, Lee, & Park, 2012). Basing decisions, strategies, and even attempts at innovation on past data means churning out much of the same, possibly with just a variation in colour or flavour. To ensure divergence in thinking, a team makes rules of learning from each other contributions and building on them (Tang, 2019).

The design process team leader must have all attention on attaining key goals, of course, with the help of Design Thinking Team Manifesto (Lee, Ostwald & Gu, 2020). Goals have a persuasive way of impacting individuals from behaviors, performance to managerial level (Locke & Latham 2020). According to varied studies, individuals tend to perform excellently when given on-point, almost hard to crack but achievable goals as opposed to those with easy, non-specific to none at all. These individuals must have ample ability, accept the goals, and receive feedback related to performance (Latham, 2019).

### **Cognitive diversity and team creativity**

There has been a lot of literature on the effects of cognitive diversity on creativity in an organization for example some studies found that there is negative influences like the upsurge in disagreements as (Knippenberg, 2007; Park, Kim, Lee, & Park, 2019; Wang, Kim, & Lee, 2016) posited, leading to conflicts and discomfort thus affecting social integration and team performance whereas (Chua, Roth, & Lemoine, 2014) found out that cognitive diversity has negative costs and interrupt group function by reducing its growth, strengthening conflicts and misconstructions, reducing member satisfaction and reducing collaboration. Some researchers like (Cronin & Weingart, 2007; Dougherty & Johnston, 1996; Srikanth, Harvey, & Peterson, 2016) showed that cognitive differences usually led to negative results such as incomprehension, pressure and mental clashes, which ultimately affected the performance of the team and its creativity whereas (Armstrong & Priola, 2001; Economo, Hong, & Page, 2016; Vance et al., 2007) opined that the differences among team members in the meaning of a word or concept can reduce the effective exchange of knowledge between them (Moore, Fredheim, Wyss, & Beste, 2021).

In contrast, the researchers (Cox & Blake, 2011; Dyer & Saavedra, 1996; Nemeth, Jeanne, 1986) observed that a heterogeneous team has the ability to generate quality decisions resulting in higher creativity since it owns a wider range of skills, know-how, perspectives as well as experiences. This leads to the members appreciating one another's differences resulting in broader spectrum of new and creative ideas. This makes diverse teams to be more creative than homogenous teams (Rink & Ellemers, 2007, 2010). The theoretical argument of value-in-diversity according to Perry-Smith and Shalley's 2003, proposes that, a broader exposure inspires one to varied perspective sharing leading to improved team creativity and thus better performance. According to (Parayitam & Papenhausen, 2016; Shin et al., 2012; Somech & Drach-zahavy, 2013; Wang et al., 2016), creativity is arrived at by integrating the rich pool of knowledge, ideas, abilities and perspectives from other team members by generating novel ideas based on the way the employees exploit the diverse thought processes. The functional backgrounds entrenched in a team, according to (Parayitam & Papenhausen, 2016) enables it to gather, process and summarize varied information, thereby resulting in team creativity, which is the combined efforts to improve a firm's products and processes by producing new and useful ideas thereby gaining a competitive advantage over their competitors (Cirella, 2016).

To explore on this notion, the study proposes that cognitive diversity should be related positively with team creativity as it strengthens a team in opening up to new information, having an in-depth exploration of the problem, collecting feedback from various stakeholders, frequently reviewing and ultimately broadening the stock of knowledge and the comprehension of novel ideas and therefore resulting in novel solution. Research in creativity management exposes a positive relationship of cognitive diversity in terms of a team's ability to generate creative solutions (Mitchell et al., 2017), therefore, we posit that;

***H1: cognitive diversity is positively related to team creativity.***

### **Cognitive diversity and design thinking**

There is great change and diversity in today's business sector, Technology advancement has led many entrepreneurs to invest in diverse thinking teams. Demand for acquisition of skills is high in the 21<sup>st</sup> century Organizations [Arnab, Clarke, & Morini, 2019]. Few studies have conceptualized inclusion as a natural outcome of cognitive diversity which strengthens and reinforces creativity (Badke-Schaub, 2020). Employees may feel more enthusiastic once their ideologies get accommodation from their group. This leads teams to design thinking process. DT according to ( ) is a non-linear interactive process that team uses to understand users, challenge assumptions, redefine problems and creative innovative solutions of any given project. DT helps frame a problem in a way that drives outcomes, teams to be aligned to the project feedback and bring together all stakeholders to reflect on their work ( ) as well as being empathetic to users by inculcating their feedback and seeking also the help of experts. Moreover an individual feels motivated and exhibits creativity when suggestions and ideas are welcomed in a group (Carlgrén, Rauth, Elmquist, & Management, 2016). The perceptions of being part of the group and organizational decision-making process, having access to unique information and sharing a

"connection" with co-workers, make an employee intrinsically motivated to learn and share know, 2018. This contributes to design thinking

(Lee, Ostwald, & Gu, 2020. Cross disciplinary teams are believed to have great cognitive diversity outcome (Acar, Tarakci, & van Knippenberg, 2019). It involves togetherness of people with varied personalities adding richness to their expertise (Kress & Schar, 2012). DT can be used as a strategic decision making tool without high degree of technical expertise. A diverse team has the ability to generate quality decisions resulting in higher creativity owing to multiple skills set, perspectives and experiences. This leads to appreciation of one another's differences resulting in broader spectrum of new creative ideas (Cox & Blake, 2011).

Individuals within specific departments with specialist skills in specific business functions approach problem solving on their own level of capability, using the skill set they feel most comfortable with Liedtka, 2018 therefore the merging of them all can result in creative volcano. Lissack's commentary has occasionally noted the individual view in terms of understanding, perspective taking and willingness to change interpretations. Some of the challenges that come with new team in terms of ambiguity and working with complex problems are being overwhelmed by different ways individuals learn and internalize information. These designed ways of understanding challenge members to reconsider who they are solving the problem for, giving them a chance to think about when, why and the how of decisions. Diverse skills and perspectives brought together through well designed collaboration are essential to team success. Collective comprehension can help with cognitive load, as variables increase, team members can work hand in hand to share tasks of understanding, explanation and analysis. Approaching problems in diverse teams serves to expand perspective and understanding which is a key requirement of design thinking process. We can therefore hypothesize:

**H2: Cognitive diversity is positively related to design thinking in a creative team.**

### **Design thinking and team creativity**

Choosing the perfect team may not always be possible, especially in situations where there is a limited pool of candidates. Within current organizational environment, there arises the need to integrate multi-disciplinary personnel with varied cognitions in order to achieve the desired creativity. Design thinking therefore can be defined as an interactive method to creativity which is focused on probing of ideas, testing of the same ideas and simulating the same as described by (Lau, Beckman, & Agogino, n.d.; O'Neill & Salas, 2018; Plattner, Meinel, & Leifer, 2015). Studies have shown that Design Thinking is used as a tool for disentangling multiple and varied organizational challenges, for example, attaining novel products, services and process improvements or development. Looking at its attributes like user focus, which is the ability to engross oneself into the users understanding to know their problems, needs and expectation through ethnographic tools, design thinking is positively related to team creativity as this knowledge helps firms translate that information to novel and better quality outcomes which will be accepted and owed by the users since their input was considered (Brown & Katz, 2011; Carlgren, Elmquist, & Rauth, 2014; Carlgren, Rauth, & Elmquist, 2016; Liedtka, 2014). This according to management literature constitutes to creativity since it's the development of results to solve real consumer problems (Grif, Price, Vojak, & Hoffman, 2014)

Team creativity can also be derived from ideation process which succeeds with exploration and cognitive challenges. Research and expanded ideation processes use brain-writing as an alternative to brainstorming. The intense discussion of the design thinking team makes it possible to incorporate, improve and update the prevailing information construct (Tims et al., 2013), with the understanding that team creativity according to (Shin & Zhou, 2007), is the generation of valuable and original ideas and concepts, therefore, incorporating and leveraging varied information and ideas and perspectives is the essence of increasing team creativity (Hoever et al., 2012).

It is therefore proposed that the use of design thinking in a cognitive diverse team increases its creative performance and thus hypothesize,

**H3: design thinking is positively related to team creativity**

H3: (1): Design thinking team mediates the positive relationship between cognitive diversity and team creativity such that cognitive diversity is positive but indirectly related to increased team creativity.

### **Moderating role of goal learning orientation**

Goal learning orientation is a mental frameworks that follows and reflects a person's understanding of task achievement, the nature of ability as well as performance Dweck & Leggett, 1988; Elliot & McGregor, 2001), and thus represent what people value in achievement situations therefore affecting how they approach, interpret and respond to tasks in achievement situations Dweck & Leggett, 1988; VandeWalle, Brown, Cron, & Slocum, 1999. High goal learning orientation expresses itself in deep-level information processing (e.g., Dupeyrat & Mariné, 2005; Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000; cf. Chaiken & Trope, 1999). As such, drawing from literatures on deep-level diversity (cognition) and goal orientations, we can posit that diversity in learning orientations as well as performance orientation can minimize the disruption of team design thinking dynamics resulting in different creativity performances. The effect on goal orientation diversity comes as a result of

challenges with communication and coordination as they are the key to team functioning. Team members may accentuate different information, interpret information in reference to different goals or differ on the magnitude of analysis of particular information as a result of differences in goal learning orientation.

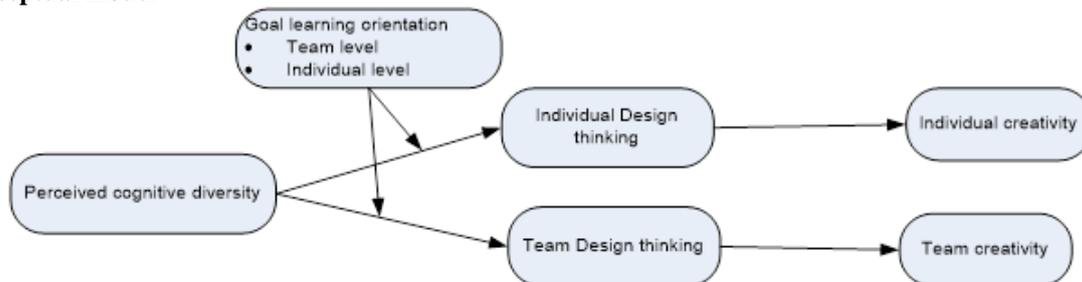
Studies in collective task depictions posits that such dissimilarities in task approaches may ruin communication among and between team members e.g., Marks et al., 2000; Mathieu et al., 2005, whose information elaboration depends on combined effort of team members' capability to exchange, deliberate and Integrate information. Therefore its irrational when team members emphasize on varied types of information with varied goals on mind, for instance, (those who have in-depth processing focus for deeper understanding verses those who focus on informational cues for application on decision heuristics), as team members will not be able to follow up on each other's comments, cues and observations as they seem to be irrelevant to ones' own informational perspective and processing intents. This can discourage attempts at more deliberations and discussing varied points of views it shows that contributions to discussions may not be acknowledged and appreciated by the team Edmondson, 1999. Goal learning orientation helps a team have a common frame of reference in task understanding and implementation hence allowing team members to anticipate each other's behaviour and therefore aligning and integrating each other's contribution Cannon-Bowers & Salas, 2001. In contrast, groups without common goal learning representation, communication and coordination thereof is difficult and requires team members to further elaborate and ask for clarifications Cannon-Bowers, Salas, & Converse, 1993; Espinosa, Lerch, & Kraut, 2004; Salas & Fiore, 2004) further resulting in more time consumed in team interactions cf. Hambrick, Cho, & Chen, 1996). We can therefore posit that,

**H4: Goal learning orientation moderates the positive relationship between cognitive diversity and design thinking, such that the relationship is stronger when Goal learning orientation is high rather than low.**

The above extrapolations suggests first-stage moderation Edwards & Lambert, 2007, therefore we can propose the following:

**H5: Goal learning orientation moderates' indirect relationship in cognitive diversity has with creativity via Design Thinking such that the indirect relationship is stronger in team levels**

**Conceptual model**



Source (Authors, 2025)

Figure 1: Conceptual model

**III. Material And Methods**

**Participants and procedure:** Data was collected from various department of Safaricom PLC, (product and service organization in Kenya and Crown paints PLC . 10 teams comprising of 15 members each were used that is 5 teams from each company. The company is a telecommunication provider which has extended its services to e-commerce and also manufacturing company. The researcher put more emphasis on 5 departments of corporate strategy, marketing, risk management, research and product development. Teams were created from the cross sectional departments comprising of 15 members. Similar tasks were selected from each of the above teams. The author cooperated with senior personnel who were the contact persons that obtained the list of the selected departments and team members. In all the 10 teams we had 150 members to which 90 respondents were obtained (response rate =60%). Team members were necessitated to partake in the survey. Response rate was from 82% for teams ranging from 75% to 100% in response rate. This survey was voluntarily with assurance of anonymity. Pre-codded questionnaires were assigned to the participants to match subordinates and supervisors. Team members assessed the comprehension of DT and levels of DT. They also evaluated cognitive diverseness and team goal learning and team leaders accessed creativity. Among the 10 member-leader pair surveys apportioned, 90 complete ones were brought from 6 teams. Of the team members 40% were female, the average age was 30.4years (SD=5.9), average team span was 4.0 months (SD= 2.7), and average organization tenure was 5.4 years (SD- 5.3) for supervisors , 23% were female, the average age was 37.4 and average organization tenure was 8.6 (SD=5.2)

## Measures

**Perceived cognitive diversity:** We assessed perceived cognitive diversity using Kim, David & Liu, 2021 four-item measure. Specifically, team members were asked to gauge on a seven-point Likert-type scale (1 = "To a very small extent"; 7 = "To a very large extent") the extent to which their team members contrast (a) in their intelligence (b) in how they view the world, (c) in their knowledge and skills, and (d) in their beliefs about what is right and wrong.

**Design Thinking:** To evaluate Design thinking, we used the five-item scale of Lin, Shadiev, Hwang, Shen, 2020. We urged team members to show the extent to which they are interested and engaged in their current tasks. An example item includes "I am currently engaged in my tasks because I find delight engaging in analytical thinking." To assess team design thinking, we made use of the measure of individual thinking and analytical skills of Lin et al. 2020 and altered the focal referent from the individual (i.e., "I") to the team (i.e. "our team").

**Individual creativity:** We asked the team leaders to assess the individual creativity of their subordinates using Zhou and George's (2019) 13-item scale on a five-point Likert-type scale (1 = "Strongly disagree," 5 = "Strongly agree"). An example item includes "Searches out new technologies, processes, techniques, and/or product ideas."

**Team creativity:** To assess team creativity, we used Shin and Zhou's (2017) four-item scale and asked team leaders to assess team creativity. The seven-point scale (1 = "Poorly," 7 = "Very much") was used to measure the responses to the following example questions: (a) "How well does your team produce new ideas?" and (b) "How useful are those ideas?"

**Goal orientation:** Goal learning orientation was measured using the validated 8-item questionnaire of Button et al. (1996), an example item included, "the opportunity to learn new things is important to me"

**Control variables:** Several control variables were included for instance, we controlled for age, sex, and organizational tenure that might influence individual creativity, consistent with prior research (e.g., Shin et al., 2012). In addition, we controlled for several variables at the team level, namely, team size, average team tenure, sex diversity, and organizational tenure diversity, to partial out their potential influences on team creativity, consistent with other studies (e.g., Harrison et al., 2002; Shin et al., 2012). We used the standard deviation for organizational tenure diversity and Blau's index for sex diversity. We also controlled for task interdependence (i.e. "The work I usually do is a group task rather than an individual task") that could meaningfully effect the creative processes (van der Vegt & Janssen, 2003). Lastly, we controlled for the team elaboration of task relevant information, by looking at how team members exchange, discuss, and integrate ideas, knowledge, and perspectives that are relevant to a team's task (van Knippenberg, De Dreu, & Homan, 2004). Some scholars (e.g., Hoever et al., 2012; Kearney & Gebert, 2009) demonstrated that team elaboration of task-relevant information represents the cognitive mechanism that links cognitive team diversity and individual and team creativity. We measured this factor using Kearney and Gebert's (2009) four-item measure. An instance is; "The members of this team complement each other by openly sharing their knowledge."

## IV. Result

The researcher conducted a confirmatory factor analysis using SPSS 22.0 to evaluate the discriminant validity of the key variables (i.e., perceived cognitive diversity, individual and team design thinking, team elaboration of organization and goal orientation, and individual and team creativity). Three-item parcels for the measures with more than three items to adequately assess the model with the large parameter-to-sample size ratio (e.g., Beauducél & Wittmann, 2005). We measured the model fit using the chi-square statistics, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean-square error of approximation (RMSEA). The eight-factor model fit the data well ( $\chi^2[224, 382] = 392.75; p < .01, CFI = .98, RMSEA = .04, and TLI = .97$ ). Moreover, it fits better than the seven-factor model (i.e., combining team goal orientation and individual goal orientation,  $\chi^2[231, 382] = 1007.77, p < .01, CFI = .89, RMSEA = .09, and TLI = .87$ ), and the six-factor model (i.e., conjoining team and individual goal orientation and linking team and individual design thinking,  $\chi^2[237, 382] = 1401.45, p < .01, CFI = .84, RMSEA = .11, and TLI = .81$ ), combining team goal orientation and team design thinking and combining individual learning goal orientation and individual design thinking,  $\chi^2[237, 382] = 703.60, p < .01, CFI = .93, RMSEA = .07, and TLI = .92$ ). Our results supported the distinctiveness of the constructs used in this study. We looked at the within-team agreement for perceived cognitive diversity, and team design thinking formulated on the within-group inter-rater reliability (rwg) (James, Demaree, & Wolf, 1984) and generated median values of .89, .91, and .92, respectively. We also calculated intra-class correlations (ICC agreement) to examine whether team membership could significantly explain the variance in individual responses (ICC [1]) and to assess the reliability of team-level means (ICC [2], Bliese, 2000). The ICC1 (ICC2) estimate was

.42 (.81) for perceived cognitive diversity, .48 (.84) for elaboration goals, and .55 (.88) for team design thinking. These numbers generally meet the levels found in previous studies on aggregation issues (e.g., Kirkman, Chen, Farh, Chen, & Lowe, 2009). We therefore aggregated the individual responses to the team level.

**Descriptive Statistics:**

**TABLE 1. Means, Standard Deviations, Correlations, and Coefficients for Variables**  
1-1: Among Individual-Level Variables

	M	SD	1	2	3	4	5	6				
1. Age	30.40	5.90	—									
2. Sex	.40	.49	.05	—								
3. Organizational tenure	5.36	5.31	.77	.05	—							
4. Individual goal orientation	5.37	1.08	.05	.01	.07	(.92)						
5. Individual design thinking	5.10	1.00	.07	.01	.14	.69	(.87)					
6. Individual creativity	3.48	.69	.06	.03	.07	.23	.27	(.93)				
1-2: Among Team-Level Variables												
	M	SD	1	2	3	4	5	6	7	8	9	10
1. Team size	5.42	.82	—									
2. Average team Tenure	3.99	2.66	.04	—								
3. Task interdependence	5.02	.94	.14	.06	—							
4. Organizational tenure diversity	3.28	2.53	.03	.48	.04	—						
5. Sex diversity	.35	.18	.02	.07	.14	.07	—					
6. Team elaboration of task-relevant information	5.02	.83	.07	.15	.36	.02	.04	(.90)				
7. Perceived cognitive diversity	4.17	.66	.08	.03	.04	.11	.05	.27	(.81)			
8. Team goal orientation	4.92	.69	.04	.02	.53	.12	.11	.52	.06	(.86)		
9. Team design thinking	4.87	.91	.04	.03	.36	.07	.06	.78	.26	.53	(.90)	
10. Team creativity	5.05	1.05	.04	.12	.09	.01	.09	.43	.34	.16	.49	(.89)

Note. 1-1: (N = 150). Reliabilities are in parentheses. For all correlation above |.10|,  $p \leq .05$ ; and above |.12|,  $p \leq .01$ . 1-2: (N = 90). Reliabilities are in parentheses. For all correlation above |.20|,  $p \leq .05$ ; and above |.25|,  $p \leq .01$ .

The means, standard deviations, reliabilities, and correlations are reported in Table 1. The teams worked highly interdependently (M = 5.28). The reliabilities for all measures were acceptable (i.e.,  $\alpha > .70$ ). Major differences were found across organizations in individual task elaboration ( $F(66, 484) = 2.45, p < .01$ ), individual design thinking ( $F(66, 484) = 2.63, p < .01$ ), and team creativity ( $F(66, 41) = 1.64, p < .05$ ). In dissimilarity, team design thinking did not display significant differences ( $F(34,41) = 1.04, n.s.$ ). Thus, we controlled for any confounding effects of organization-level factors by allowing a random intercept at the organizational level.

**TABLE 2. The Effects of Perceived Cognitive Diversity and Team Learning Orientation on Team Out-comes**

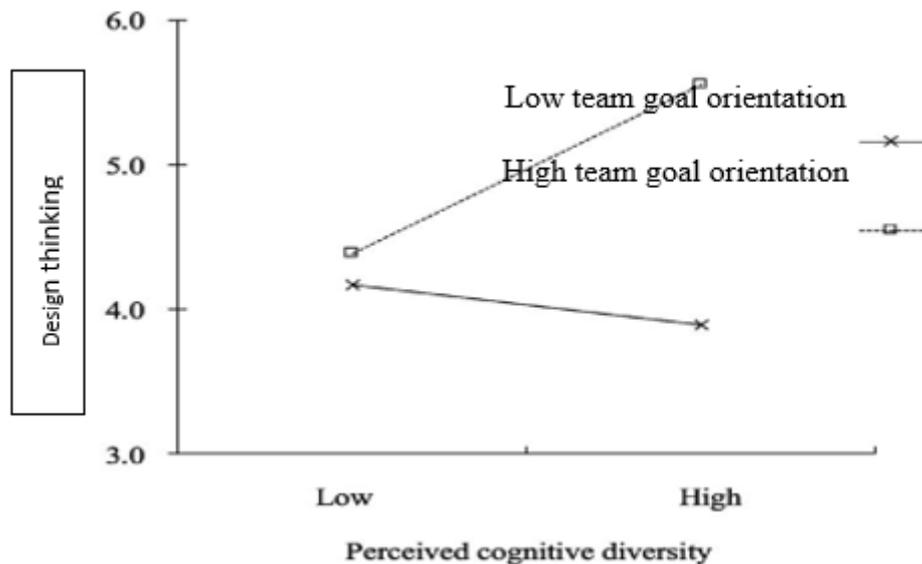
Variables	Team Design Thinking			Team creativity		
	M1	M2	M3	M4	M5	
Intercept		2.29**	.18**	4.50**	2.98**	2.82**
Team size	.08**	.06**		.01**	.03**	.00**
Average team tenure		.03**	.04**	.01**	.06**	.03**
Task interdependence	.35**		.07**	.07**	.08**	.08**
Organizational tenure diversity	.03**		.05**	.03**	.01**	.01**
Sex diversity		.12**	.05**	.12**	.53**	.50**
Team elaboration of task-relevant information						.12**
Perceived cognitive diversity	.33**		.37**	.34**	.53**	.32**
Team goal orientation		.70**	.68**			.12**
Perceived cognitive diversity 9 Team learning orientation			.79**			.07**
Team design thinking						.48**

pseudo R <sup>2</sup>	.20**	.40**	.52**	.15**	.32**
Note. (N = 10 teams, 2 companies). *p < .05, **p < .01 (one-tailed).					

It was affirmed that goal learning orientation would moderate the relationship between perceived cognitive diversity and design thinking, so that the correlation would become positive and stronger as creativity increased at both individual and team levels.

Model 3 in **Table 2** shows that the interaction term of perceived cognitive diversity and team creativity was significant  $\beta = .79, \beta < .01$ ). Specifically, the simple slope tests showed that the relationship between perceived cognitive diversity and team design thinking was positive and significant when team creativity was high (simple slope = .89,  $\beta < .01$ ), but was not noteworthy when it was low (simple slope = -.21, *n.s.*). The simple slope results are presented in (**Figure 1**.)

**Figure 1: Simple slopes of perceived cognitive diversity on team design thinking at levels of team learning orientation.**



**TABLE 3. The Effects of Perceived Cognitive Diversity and Individual Learning Orientation on Individual Outcomes**

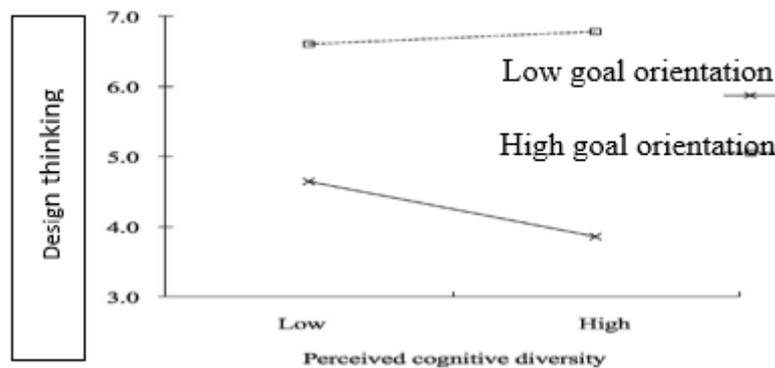
Variables	Individual Design thinking			Individual creativity	
	M1	M2	M3	M4	M5
Intercept	3.15**	.07**	5.47**	1.84**	2.83**
Level-1 variables					
Age	.01**	.00**	.00**	.00**	.01**
Sex	.04**	.00**	.00**	.03**	.03**
Organizational tenure	.01**	.01**	.01**	.01**	.01**
Individual learning orientation within-team part		.49**	.50**		.00**
Individual design thinking					.07**
Level-2 variables					
Team size	.04**	.00**	.03**	.07**	.10**
Average team tenure	.02**	.03**	.02**	.04**	.02**
Task interdependence	.18**	.11**	.13**	.02**	.24**
Organizational tenure diversity	.15**	.06**	.09**	.07**	.12**
Sex diversity	.01**	.01**	.00**	.06**	.05**
Perceived cognitive diversity	.18**	.09**	.23**	.04**	.32**
Individual learning orientation between-team part		1.13**	1.16**		1.44**
Perceived cognitive diversity 9			.34**		.39**
Individual learning orientation between-team part					
pseudo R <sup>2</sup>	.45*	.58*	.58*	.35*	.37*

Note. (N = 150 individuals, 10 teams, 2 organizations). Results of 34 dummy variables are not included in the table. \*p < .05, \*\*p < .01 (one-tailed).

In addition, Model 3 in **Table 3** shows that the interaction term of perceived cognitive diversity and individual creativity was also significant  $\beta = .34, \beta < .05$ ). Here, ingenious slope tests showed that the relationship

between perceived cognitive diversity and individual design thinking was inconsequential when individual creativity was high (simple slope = .14, *n.s.*), but was negative and significant when it was low (simple slope = -.60,  $\beta < .05$ ). The simple slope results are presented in (Figure 2). Thus,

**Figure 2: Simple slopes of perceived cognitive diversity on team design thinking at levels of individual learning orientation.**



**Hypothesis 1 received partial support.**

Hypotheses 4 projected that goal orientation would moderate the indirect relationship that perceived cognitive diversity has with team creativity via design thinking, such that the indirect relationships strengthens as goal orientation intensifies at both individual and team levels. First, as shown in Table 2 (Model 5), team design thinking(H3) was significantly associated with team creativity  $\beta = .48, \beta < .01$ ) after controlling for team size, team average tenure, task interdependence, organizational diversity, and team elaboration of tasks as well as perceived cognitive diversity. In addition, the moderated path-analytic procedures showed that the indirect relationship that perceived cognitive diversity has with team creativity through team design thinking was not significant when task elaboration was low. The mediated(H4) path-analytic procedures showed that the indirect relationship that perceived cognitive diversity has with individual creativity through individual design thinking was not significant when team task elaboration n was high (indirect effect = .01, 90% CI = [.01, .026]) but became significant when it was low (indirect effect = -.05, 90% CI = [-.124, -.002]). The difference in the indirect relationships was significant (Dc = .06, 90% CI = [.001, .068]). Although 90% CI are less stringent than 95% CI, they are acceptable in multilevel studies with intricate data structures (e.g. gross et al, 2011). The model tested (2-1-1 model) contains five research variables (excluding eight control variables) that are tested in a serial moderated mediation path with two levels even controlling for individual task elaborations within-team part, which needs the conservation of statistical power. Taken together, these results provide support for a team-level moderated mediation effect, and limited support for an individual-level moderated mediation effect.

As a supplementary analysis, we ran a sensitivity test to check the robustness of our findings without controlling for team elaboration of task-relevant information (which is highly correlated =to team design thinking,  $r = .78$ ). These findings indicated that all significant results remained the same shows without controlling for team elaboration of task-relevant information. For example, in Model 5 in Table 2, team design thinking was significantly related to team creativity ( $\beta = .55, p < .01$ ). All detailed results are available upon request from the authors. Due to the variance in individual design thinking and team design thinking evaluation among team members, we put together mean and SD of team-level design thinking to account for both mean levels and the variability in the team. The results showed that the effect of mean levels of team design thinking on team creativity remained similar, but the effect of SD levels of team design thinking on team creativity was not significant (for individual design thinking ,  $\beta = .09, n.s.$ ; for team design thinking,  $\beta = .20, n.s.$ ).

**V. Discussion**

Our study provides important theoretical implications for the diversity and creativity literatures and suggests openings for more in-depth future studies. First, this study theorizes and tests a design mechanism that links perceived cognitive diversity with individual and team creativity. Despite the importance of understanding how cognitive team diversity facilitates creativity, only a few studies (e.g., Hoever et al., 2012; Kearney & Gebert, 2009) have examined the cognitive mechanism. Departing from these studies, our findings suggest that design thinking can be an important mediating mechanism to link perceived cognitive diversity and team creativity. Our study also demonstrated the incremental predictive power of team design thinking in associating perceived cognitive diversity and team creativity above and beyond team elaboration of task-relevant information. As such, our findings extend the extant research (e.g., Hoever et al., 2012; Kearney & Gebert, 2009) showing that team

elaboration of task-relevant information significantly mediates the link between cognitive diversity and team creativity. These findings imply that the design thinking mechanisms represent a novel and useful addition to the cognitive mechanism regarding how cognitive team diversity influences creativity. In addition, our results suggest that earlier findings on the effects of perceived cognitive diversity on team design thinking among employees (Wang et al., 2016) can be generalized to employees in other cultural contexts. Second, our findings extend the research on perceived cognitive diversity and creativity at a single level (e.g., for team-level creativity, Hoever et al., 2012; Wang et al., 2016; for individual creativity, Shin et al., 2012) by examining the relationships between perceived cognitive diversity and both individual and team creativity.

Furthermore, we examined whether the relationships among the same constructs generalize across different levels (i.e., multilevel models in the strict sense, Zhou & Shalley, 2011). Specifically, we contribute to theory and research on creativity by demonstrating that design thinking links the relationship between perceived cognitive diversity and both team and individual creativity similarly. In addition, we also demonstrate similar moderating effects on both of these links, thereby enhancing theoretical parsimony. Highlighting these moderating effects of team goal orientation can also enrich the emerging research on team goal orientation. Deviating from studies that indicate that team goal orientation is positively associated with team creativity (e.g., Gong, Kim et al., 2013), the current study reveals that team learning goal orientation significantly amplifies the potential benefit of perceived cognitive diversity in team design thinking and subsequently creativity. Our findings also suggest that team goal orientation research can benefit from the consideration of team types (e.g., cognitively diverse teams) as potential boundary conditions. Third, the moderating roles of individual and team goal orientation also contribute to the current understanding of how design thinking processes may interact to shape individual and team creativity.

Creativity research has generally examined cognitive and motivational approaches separately (Zhou & Shalley, 2011). In particular, the role of motivational variables as potential boundary conditions has not been substantially examined in the research on perceived cognitive diversity and creativity. We integrated the cognitive (i.e., perceived cognitive diversity) and DT approaches and demonstrated that they interact to shape creativity in distinct ways. These variables act as boundary conditions for the cognitive approach and provide a potential explanation for the prior mixed findings (e.g., Pieterse et al., 2011; Shin et al., 2012). It is important to note that contrary to our expectancy, the moderating effect of individual goal focus on the indirect relationship between perceived cognitive diversity and creativity through individual design thinking was not meaningful. It is likely that perceived cognitive diversity has ambivalent implications for individuals with high learning goal orientation dependent on the personal traits of the individuals. For instance, even when people emphasize learning and competence development, those with an internal locus of control may not be thrilled by external factors (e.g., perceived cognitive diversity) to progress their knowledge and skills while those with an external locus of control can be more influenced by others' diverse ideas. Future research should further scrutinize the explanations for this unanticipated finding and resolve whether the outcome is R&D team-specific or generalizable to other types of teams.

**Managerial implications:** Alongside its input to theory, this study offers numerous important hands-on considerations for managers and organizations. First, organizations are increasingly putting together cognitively diverse teams and assigning them innovative tasks, but their success has been mixed. Effectively managing diverse teams is critical to ensure that they are able to reap the benefits of heightened fairness perceptions and sustained competitive advantage (Yang & Konrad, 2011). Our findings recommend that managers interested in boosting creativity in teams with high standards of cognitive team diversity should develop a solid team goal orientation. Without such an orientation, the potential of cognitive team diversity will not be fully unleashed. Managers may enhance team goal orientation by respecting and encouraging the team to share their expertise, intellectually stimulating subordinates, and enhancing knowledge sharing, and supporting subordinates to take risks and learn from their mistakes, this result in actively engaging in design thinking. In addition, our results suggest that the formation of cognitively diverse teams may be a valuable method to making jobs enjoyable, by encouraging design thinking process, and to foster creativity, particularly when the jobs are not inherently encouraging grounded on their inherent requirements. This implication is practically important because not every job can be intrinsically designed to require high creativity. Yet, every job requires definite levels of creativity to create better job performance. For instance, sales jobs generally do not need high levels of creativity and are not inherently enjoyable, but sellers need to be creative to meet various customer demands. In this case, creating a sales team with perceived cognitive diversity (and inspiring individual and team learning) can help encourage both design thinking and creativity. Managers may also wish to foster the growth of perceived cognitive diversity within teams by encouraging employees to seek feedback from diverse sources (e.g., De Stobbeleir, Ashford, & Buyens, 2011). Equally, when jobs require creativity and are intrinsically interesting, building cognitively diverse teams may not be important. This outcome is important because the perception of perceived cognitive diversity may bring some unpremeditated consequences (e.g., conflict).

## VI. Conclusion

It is of no doubt that cognitive diversity are what we need to succeed when we are dealing with new, uncertain, and complex situations, there is need to encourage people to reveal and deploy their different modes of thinking. It's imperative to make it safe and encourage diverse thoughts through a structured way so as to harness many advantages of expertise, experience as well as knowledge while minimizing the effect of their diversity like conflicts. This means team leaders will have to get much better at building their team's goal learning orientation so that team members can look and approach challenges from a common reference.

Leaders can also encourage cognitive diversity in their daily practices. For example, when everyone seems in lockstep on a decision, "find someone who disagrees and cherish them," Reynolds and Lewis wrote, "Cultivate an environment where team members know they can speak anytime, ask questions and express dissent". Management should train employees to understand and be aware of their unconscious bias so that they can better collaborate with others who differ from them.

The management should also put into place various policies which encourage collaborative creativity and reward creative ideas which later transform into innovations.

Thus, being exposed to cognitive team diversity, whether purposefully or not, individual team members are more able to combine and build on different ideas and to experiment with these ideas from different perspectives. That is, with the abundant cognitive resources from cognitive team diversity, individual team members are likely to exploit the various ideas and perspectives of other team members to generate creative ideas in a context requiring creativity.

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