Activating the benefit of task diversity through team role clarity and implicit coordination

Abstract

Over the last several decades, studies on the relationship between task knowledge diversity and team performance have yielded mixed findings. Extending past studies, we propose that the impact of task knowledge diversity on team performance is dependent on the level of team role clarity and implicit coordination. This study, based on two-wave time-lagged data from 62 teams comprising 336 individuals, provided support for the proposed model and showed that team role clarity and implicit coordination moderate the relationship between task knowledge diversity and team performance. Overall, task knowledge diversity has a positive effect on team performance when either team role clarity or implicit coordination is high, and this effect is even stronger when both are high.

Keywords: task knowledge diversity, team role clarity, implicit coordination, team performance

Activating the benefit of task diversity through team role clarity and implicit coordination

Companies assemble cross-functional teams (CFTs) to augment their competitive advantage (Zhang & Guo, 2019). Team members come from different functional departments (e.g., marketing, production, finance, and purchasing) and play different roles in cross-functional teams (Kaufmann & Wagner, 2017). Therefore, members of cross-functional teams always have diverse task-related knowledge (Kaufmann & Wagner, 2017). Recently, many scholars have studied how to activate the benefits of task knowledge diversity. Based on information/decision-making theory, scholars generally claim that knowledge diversity is positively associated with team performance (Cox & Stacy, 1991; Stasser et al., 1995; Williams & O'Reilly, 1998) because diverse teams are likely to have a larger pool of knowledge resources that may be helpful in handling complex problems. Although this view is supported by many studies (e.g., Bell et al., 2011; Horwitz & Horwitz 2007; Mannix & Neale, 2005; Pelled, 1996; Wittenbaum & Stasser, 1996; Yang & Yang, 2014), some studies find an insignificant relationship between knowledge diversity and team performance (e.g., Haas, 2010; Pelled et al., 1999; Polzer et al., 2002). Therefore, current scholars have aimed to reconcile these inconsistent predictions.

Harrison and Klein (2007) claimed that the reason for the mixed relationship between team diversity and team performance is that the specific concept of diversity is unclear. This study responds to the call of Harrison and Klein for explicitly specifying diversity. The task knowledge diversity in our study, thus, is consistent with the conceptualization of variety. We define task knowledge diversity as "the degree to which a team's reservoir of task-relevant knowledge and skills is distributed and specialized among team members" (Park et al., 2018, p. 1613).

Van Knippenberg et al. (2004) proposed the categorization–elaboration model (CEM) to

improve information/decision-making theory. Specifically, the CEM proposed that the elaboration of knowledge is the underlying process that motivates the benefits of knowledge diversity (Van Knippenberg et al., 2004). This paper believes that the CEM overlooks the specific flow orientation during the exchange of task-related diverse knowledge. Instead of randomly transferring diverse knowledge, specific knowledge may be delivered to a specific member within a team. When team members exchange specific knowledge with specific colleagues, the benefits of task knowledge diversity can be activated.

In other words, diverse task knowledge can be better elaborated through the processes of learning and sharing (Grand et al., 2016). Individual members not only need to proactively learn task knowledge from their colleagues but also should spontaneously share such task knowledge with other team members. Moreover, this study argues that these dynamic processes are influenced by contextual factors. Accordingly, we propose two contextual factors—team role clarity and implicit coordination—and examine whether they moderate the relationship between task knowledge diversity and team performance.

Team role clarity means that each individual team member has a clear understanding of his/her tasks and a particular role in the team (Bray & Brawley, 2002), and it plays an essential role in motivating individual members to learn from other team members. We believe that when team members understand the duties and demands of their roles, they will know what they need to accomplish team tasks (Chong, 2015; Curnin et al., 2015). When they recognize that they lack adequate task knowledge, they can learn from their colleagues. Seeking and using colleagues' task knowledge to complete team tasks contributes to team performance (Drach-Zahavy & Somech, 2002).

Second, we consider the moderating role of implicit coordination. Implicit coordination means that team members can predict their colleagues' behaviors and needs and will adjust their own actions accordingly, without needing active communication (Espinosa et al., 2004;

Wittenbaum et al., 1996). Implicit coordination may affect the efficiency of knowledge sharing among team members. We assume that when individual members can anticipate the demands of other team members, they will spontaneously share task knowledge with their colleagues (Chang et al., 2017). In such a situation, team members gain the necessary task knowledge without having to request it, which enhances team performance.

In summary, our study makes three contributions. First, we examine the moderating effects of team role clarity and implicit coordination on the relationship between task knowledge diversity and team performance, which helps to reconcile the inconsistent findings of previous studies. Second, the CEM has been supplemented and enriched. This paper confirms that the elaboration of diverse task knowledge needs to have a specific flow direction. Not only must task knowledge be delivered, but specific task knowledge must also be passed to specific members to promote elaboration. Finally, we contribute to information/decision-making theory by exploring when individual task knowledge can be used to improve team performance. Figure 1 presents our research model.

Insert Figure 1 about here

Theoretical Background and Hypothesis Development

Team diversity and team performance

Currently, scholars mainly discuss the effect of team diversity on team performance from two perspectives: social categorization and information/decision-making (Meyer, 2017). Studies based on social categorization theory claim that team diversity has a negative impact on team outcomes (Van Knippenberg & Hoever, 2017; Van Knippenberg & Schippers, 2007). In contrast, information/decision-making theory proposes that team diversity positively influences team outcomes (Van Knippenberg & Hoever, 2017; Van Knippenberg & Schippers,

2007). Accordingly, scholars have reconciled the inconsistent predictions of these two theories in four different ways (Meyer, 2017).

The first stream of research has attributed different effects to different types of diversity (Bell et al., 2011; Horwitz & Horwitz, 2007). Motivated by these inconsistent findings, Harrison and Klein (2007) conceptualized diversity as separation, variety, and disparity. Separation refers to the differences in values, beliefs, and attitudes between team members. Variety refers to the differences in task knowledge and experience between team members. Disparity refers to the difference in the perception of social value assets and resources held by team members. Harrison and Klein insisted that all types of diversity, such as age, educational background, and tenure diversity, can be conceptualized as separation, variety, and disparity. Taking age diversity as an example, if scholars adopt diversity in terms of variety, then they should study age diversity based on information/decision theory so that age diversity will have a positive impact on team performance. If scholars adopt diversity in terms of separation, then they should study age diversity based on social categorization theory so that age diversity will negatively influence team performance. That is, age diversity can be conceptualized as variety and separation and has different impacts on team performance through information/decision and social categorization approaches, respectively.

Harrison and Klein (2007) appealed to researchers to specify the type of diversity being studied and align it with specific and appropriate foundational theories. We respond to the call of Harrison and Klein for explicitly specifying that the knowledge diversity mentioned in this paper refers to variety. Hence, this paper studies the effect of knowledge diversity on team performance based on information/decision-making theory. Moreover, according to Harrison and Klein, knowledge diversity will positively influence team performance. However, the current study found that even if diversity varies with the information/decision-making paradigm, then the relationship between diversity and team

performance can still be negative or insignificant (Bell et al., 2011). Consequently, we argue that the hypothesis that conceptualization of diversity as variety reaps positive consequences still has some limitations.

The second stream of research has proposed the categorization–elaboration model (CEM) to reconcile the inconsistent predictions of social categorization and information/decision making (Meyer, 2017). Unlike in previous studies, the CEM insists that even with the information/decision-making approach, the effect of team diversity on team performance still may be insignificant or negative (Van Knippenberg et al., 2004). The CEM claims that the elaboration of team knowledge is the foundation for the positive impact of knowledge diversity on team performance; that is, when team members exchange, discuss, and integrate task knowledge, the benefit of knowledge diversity can be activated (Homan et al., 2007; Meyer & Schermuly, 2012; Van Knippenberg et al., 2004). Task knowledge diversity may not be beneficial to team performance if there is no exchange and integration of diverse task knowledge among team members (Homan et al., 2007; Meyer & Schermuly, 2012; Van Knippenberg, et al., 2004). At the same time, the CEM insists that the elaboration of task knowledge is most likely to occur when team tasks have strong information-processing and decision-making components and when team members' task motivation and ability are high (Van Knippenberg et al., 2004).

This study believes that the CEM overlooks an important point when emphasizing the role of elaboration of task knowledge. On the one hand, team members need to proactively learn task knowledge from their colleagues. On the other hand, team members should spontaneously share task knowledge with other team members (Grand et al., 2016). When team members clearly understand their roles, they can effectively identify the necessary task knowledge that they lack. Simultaneously, when implicit coordination is high, team members can anticipate others' task knowledge needs.

Another stream has argued that as long as team members perceive the differences between them, diversity in either dimension will lead to negative outcomes (Liao et al., 2008). Therefore, this study hopes that future research will examine the effect of knowledge diversity on team performance when knowledge diversity is perceived or not perceived by team members. The fourth stream of research has claimed that if teams want to reap the benefits of diversity, then they should avoid the formation of fault lines (Meyer, 2017). If fault lines cannot be prevented, then cooperation among team members from different subgroups should be reinforced (Homan et al., 2007), or pro-diversity beliefs should be instilled (Rico et al., 2012) to prevent the negative effect. Hence, this paper suggests that future research explore whether team role clarity and implicit coordination can reduce the negative effect of fault lines on team performance.

The Moderating Role of Team Role Clarity

Role theory considers roles as "a set of prescriptions that define the behavior required of an individual who occupies a certain position" (Bray & Brawley, 2002, p.234). Role clarity is defined as "the extent to which an individual receives and understands information required to do job" (Kelly & Hise, 1980, p.124). Although individual-level role clarity has been extensively studied (e.g. Donnelly & Ivancevich, 1975; Foote et al., 2005; Moynihan & Pandy, 2007; Mukherjee & Malhotra, 2006; Yadav & Rangnekar, 2015), it has been largely restricted to individuals' clarity about the tasks that are performed independently within organizations (Bray & Brawley, 2002). Few studies have focused on role clarity within small interdependent teams (Lynn & Kalay, 2015). In fact, the clearer the overall role of the team, the easier it is for members to seek and utilize useful knowledge to complete their tasks. The first purpose of the present study is to determine whether team role clarity serves as a moderator in the relationship between task knowledge diversity and team performance.

Task knowledge is distributed among team members (Schults, 1992). We believe that

the benefits of diverse task knowledge are leveraged when team members learn from their colleagues. When team members actively learn from other team members, diverse task knowledge is used more effectively (Hollingshead, 1998; Stasser et al., 1995; Wegner, 1995). We argue that this learning process is influenced by team role clarity. Specifically, when team members clearly understand the responsibilities, assignments, goals, and expectations of their roles, they know exactly what task knowledge they lack and thus what they need to learn from other team members (Donnelly & Ivancevich, 1975; Rizzo et al., 1970). In other words, when team role clarity is high, team members can effectively identify the task knowledge they need. In this situation, task knowledge diversity can effectively promote team performance. As a result, we expect that task knowledge diversity will boost team performance when team role clarity is high.

Conversely, in the case of lower team role clarity, task knowledge diversity will negatively influence team performance. When team members do not know exactly what task knowledge they need to complete role tasks, they will need more time and effort to identify and learn this useful task knowledge (Lynn & Kalay, 2015; Stewart et al., 2005). In this situation, the more diverse the task knowledge is within the team, the more easily it results in ambiguity in the variety of task knowledge and ineffective decision-making processes (Pitt & McVaugh, 2008; Tsai et al., 2014), which are not conducive to team performance.

Hypothesis 1*: Team role clarity moderates the relationship between task knowledge diversity and team performance: Team task knowledge diversity increases team performance when team role clarity is high.*

The Moderating Role of Implicit Coordination

Team coordination refers to the use of strategies and behavior to integrate and adjust the activities, knowledge, and goals of independent members to achieve common goals (Brannick et al., 1995; Malone & Crowston, 1994). Implicit coordination is the most delicate

and dynamic aspect of coordination (Rico et al., 2008). It is defined by the following process: (1) provide task-related information and knowledge to other members without request; (2) proactively share work information; and (3) adapt behavior to the actions excepted by other members (Entin & Serfaty, 1999; Wittenbaum et al., 1996). According to Rico and his colleagues' (2008), teams with high levels of implicit coordination have two characteristics: anticipation and dynamic adjustment. Anticipation is the ability of team members to anticipate the needs of other team members in advance, while dynamic adjustment is the ability of team members to respond to the needs of other members.

A team with high task knowledge diversity has a large repository of knowledge to draw on (Kristinsson et al., 2016), which is beneficial to team performance (Mannix & Neale, 2005; Pelled, 1996; Wittenbaum & Stasser, 1996). However, the process is moderated by implicit coordination because task knowledge is distributed among team members (Schults, 1992), and the benefits of task knowledge diversity can be leveraged through knowledge sharing (Grand et al., 2016). That is, sharing useful task knowledge with team members is an important way to use diverse task knowledge. We believe that team members who can clearly anticipate the task knowledge needs of their colleagues can spontaneously share their task knowledge with the appropriate colleagues (Hollingshead, 1998; Stasser et al., 1995; Wegner, 1995). Therefore, when the level of implicit coordination is high, team members can anticipate others' needs, which improve the efficiency of task knowledge transfer. As a result, we expect that the positive effect of task knowledge diversity on team performance will be greater when implicit coordination is high.

For teams with low implicit coordination, however, it is likely that the confusion concerning the anticipation of colleagues' task knowledge needs prevents team members from sharing task knowledge with their colleagues, leading to the low efficiency of knowledge sharing among team members (Butchibabu et al., 2016; Fisher et al., 2012; Lowry

et al., 2013). In this situation, the more diverse the task knowledge is within the team, the higher the costs for sharing and overloading diverse task knowledge, which will result in ineffective decision-making processes (Schmickl & Kieser, 2008; Tsai et al., 2014). Hence, task knowledge diversity cannot be beneficial to team performance.

Hypothesis 2*: Implicit coordination moderates the relationship between task knowledge diversity and team performance: Team task knowledge diversity increases team performance when implicit coordination is high.*

The Combined Moderating Role of Team Role Clarity and Implicit Coordination

According to the above reasoning, we suggest that team role clarity and implicit coordination moderate the relationship between task knowledge diversity and team performance, respectively. Given that team diversity provides a pool of knowledge and information distributed among team members, team role clarity helps effectively identify the task knowledge and information that each member needs to obtain from their colleagues (learning process), while implicit coordination helps improve the willingness and autonomy of sharing one's task knowledge and information with others (sharing process). Both of these processes are important channels for the preferable utilization of diverse task knowledge (Hollingshead, 1998; Stasser et al., 1995; Wegner, 1995). Otherwise, task knowledge diversity may not be beneficial to team performance if there is no learning or sharing of diverse task knowledge among team members.

Apart from the respective moderating roles of team role clarity and implicit coordination, it is also important to consider the combined effect of the two moderators in explaining the relationship between task knowledge diversity and team performance. We argue that there is a three-way interaction effect of task knowledge diversity, team role clarity and implicit coordination on team performance.

On the one hand, the strengthening effect of team role clarity on the relationship

between task knowledge diversity and team performance will be more pronounced when implicit coordination is high. Although team role clarity can help team members accurately identify the task knowledge that they need from their colleagues (Chong, 2015; Curnin et al., 2015), this process of gaining task knowledge from their colleagues requires coordination among team members (Wittenbaum et al., 1996). Implicit coordination can facilitate this interactive process. Specifically, when team members actively seek the required task knowledge based on role clarity, those with a high level of implicit coordination can effectively coordinate with each other (Rico et al., 2008), thereby obtaining the required task knowledge from the diverse knowledge pool more quickly, in turn promoting team performance.

On the other hand, we expect that the strengthening effect of implicit coordination on the relationship between task knowledge diversity and team performance will be more pronounced when team role clarity is high. The clearer the overall role of the team is, the easier it is for team members to understand how each role interacts with one another and who is responsible for what task (Esper et al., 2008). As such, team role clarity can help improve the accuracy of the coordination process regarding roles and diverse knowledge (Deeter-Schmelz, 1997). In other words, when providing and sharing task-related information and knowledge to other members without requests, team members with role clarity can more accurately promote the matching between roles and task knowledge (Klein et al., 2009), in turn contributing to team performance.

Hypothesis 3*: Team role clarity and implicit coordination jointly moderate the relationship between task knowledge diversity and team performance: The positive relationship between task knowledge diversity and team performance is strongest when team role clarity and implicit coordination are both high.*

Method

Samples and Procedures

The data were collected from an enterprise resource planning (ERP) simulation competition, in which participating teams with six members each competed in a virtual market. Participating members carefully read the strategy of ERP sandbox simulation competition before the competition. This strategy introduces the job responsibilities and tasks of each role to guide team members to act and share information in great detail. For instance, production directors' job responsibilities include coordinating production schedules, maintaining production costs, and maintaining normal production operations and on-time delivery. The production director's tasks include developing products, purchasing/updating/converting production lines, etc. Following the guidance of the simulation, the six members played the roles of general manager, chief financial officer, financial assistant, marketing director, production director, and procurement director. The corresponding roles were not explicitly assigned to each participant according to their major, but the instructors who led the teams suggested that participants choose roles that were consistent with their own major because they thought professional knowledge may be useful. However, due to some practical constraints, the major and role of each team member cannot be guaranteed to be completely matched because the team is freely formed, and there are no clear rules that stipulate that the team must be formed in accordance with major and role matching. Because, in some teams, the actual size of a few teams was five or four members, a few members may play two roles at the same time.

The ERP simulation process covers all of the key aspects of an enterprise's operations, including strategic planning, raising capital, marketing, product development, production organization, material procurement, equipment investment and transformation, and financial accounting and management. The internal and external environments in which an enterprise operates are represented as a series of business rules. Each team is given the same amount of

capital to start. During six rounds of business operations, the groups adopt different business strategies and complete a series of business challenges.

In the beginning, the computer system provides each participating team with a fixed amount of funds, usually 6 million. Then, the task of each team is to allocate and use this money reasonably. First, team members need to choose the factory building (large, medium, or small) and production line (manual, semi-automated, or fully automated). In addition, team members need to choose the product to be produced among the many products (each product requires different resources and production cycles) and determine the market for product input (domestic or foreign and large or small). Finally, team members need to choose the advertising cost to be invested to obtain the order form. If there are only 5 order forms in the market, but the advertising cost is ranked 6th or lower, then the order forms and the advertising cost cannot be received. The computer system will provide each team with a six-year operation time and use the business results as the game scores.

After a number of simulation cycles, each team is given the objective final owner's equity value. The result of the competition is based on the final owner's equity value for each team, which is also used as team performance data in our study. Team performance is objective because the team performance is rated by the computer system (called UFIDA software) automatically. The instructor is only responsible for registering the team performance from the computer system. We obtain the team performance from the instructor. The student teams are trained on Saturday and Sunday in the first week and Saturday in the second week. They participate in the competition on Sunday in the second week. Therefore, we gain team performance after the competition on Sunday afternoon in the second week. The participants gain credits and different test scores according to the competition results.

We conducted two waves of multisource, onsite surveys, with an average interval of one week. This time lag was set so that team performance, which was assessed using the

competition results from the computer system, would not be affected by how team members responded to the team role clarity and implicit coordination measures. Specifically, we collected Time 1 data on Sunday afternoon in the first week. At Time 1, each team member completed the team role clarity and implicit coordination measures and provided demographic information such as age, gender, and specialized subject. Participants completed the measures independently and placed them in envelopes provided by the researchers. The sealed surveys were then collected. At Time 2, we obtained the team performance scores from the instructors who led the teams. Instructors only taught the student teams, and they were not involved in the game. Specifically, the instructors first taught the specific rules and procedures of the game in the classroom. Then, they guided students to simulate the whole game and suggested that students practice constantly. However, during the course of the competition, the instructor did not join in the competition and provide any information and advice.

We first contacted and invited 97 student teams to participate, of which 83 returned their completed questionnaires, yielding an initial response rate of 85.6%. Our sample was composed of undergraduates (mainly juniors and seniors). We excluded data from teams that lacked final performance scores (the instructors did not provide us with the final owner's equity values of these teams), which led to a valid sample size of 62 teams with 336 individuals.

The average size of the 62 teams was 5.4 members. Of the 336 team members, 36.0% majored in accounting, 18.2% majored in business administration, 15.8% majored in finance, 11.0% majored in public administration, 9.8% majored in economics, 5.7% majored in public finance, and 3.6% majored in communication engineering. Among the 336 respondents, 29.5% were men, and the average age was 20.9 years.

Measures

Task knowledge diversity

At the beginning of the questionnaire, respondents were asked to report their educational specialization. Task knowledge diversity was calculated based on the specifications of team members. Adjusted Blau's (1977) diversity index was used to calculate task knowledge diversity.

Team performance

Team performance was objectively assessed by the computer system (called UFIDA software) automatically. The instructor was only responsible for registering the team performance from the computer system. We obtained the team performance from the instructor. The competition results were the final owner's equity value of each team after a number of business simulation cycles.

Team role clarity

We used the 5-item measure of team role clarity developed by Rizzo et al. (1970). Because the original scale was in English, we conducted a standard process of translation and back-translation to ensure the Chinese version corresponded to the original version (e.g. Bozionelos et al., 2016). Respondents rated team role clarity using a 5-point Likert-type scale (1 = strongly disagree; 5 = strongly agree). The Cronbach's alpha was 0.97. We divided the questionnaire into six parts: general manager's role clarity, chief financial officer's role clarity, financial assistant's role clarity, marketing director's role clarity, production director's role clarity, and procurement director's role clarity. Every team member had to fill in all these six parts. Sample items were "The general manager knows what his responsibilities are," "Clear planned goals/objectives exist for the general manager's job," "The chief financial officer knows what his responsibilities are," and "Clear planned goals/objectives exist for the chief financial officer's job." The values of the six roles were then averaged.

Implicit coordination

Implicit coordination was measured with 8 items developed by Mumtaz et al. (2010). Also we conducted translation and back-translation to ensure the Chinese version corresponded to the original version (e.g. Bozionelos et al., 2016). Sample items were "Provide task relevant information without request" and "Change adjust and adopt contribution to attain common goals." Responses were made on a 5-point Likert-type scale (1 = strongly disagree; 5 = strongly agree). The Cronbach's alpha was 0.90.

Control variables

Team size and gender diversity were controlled for in this study. Gender diversity was calculated based on Blau's (1977) diversity index.

Data Aggregation

All our constructs were explicitly conceptualized at team level. Because some of the data were collected from individual responses, it was necessary to evaluate whether it was appropriate to aggregate data from individual level to team level (Chen et al., 2017). First, we calculated the interrater agreement coefficient (r_{wg}) for the variables (James et al., 1984). The median r_{wg} value was 0.98 for team role clarity and 0.97 for implicit coordination. These results suggest that team members agreed highly on their ratings of these variables.

We also computed the intraclass correlation coefficients (ICC(1) and ICC(2)) to determine whether the ratings of members from the same team were more similar to one another than to those of members from other teams (Bliese, 2000). The ICC(1) values were 0.44 for team role clarity and 0.30 for implicit coordination. The ICC(2) values were 0.81 for team role clarity and 0.70 for implicit coordination. Together, these results supported the aggregation of individual team member responses to create team-level variables for the two constructs.

Results

Confirmatory Factor Analyses

We first performed confirmatory factor analyses (CFA) to test the construct validity of our two-variable baseline model, namely, implicit coordination and team role clarity. The CFA results are presented in Table 1. The two-factor model fitted well (χ_2=212.10, df = 64, RMSEA = 0.08, CFI = 0.96). We then confirmed the discriminant validity of the two-factor model by testing a one-factor model. As shown in Table 1, the two-factor model provided a significantly better fit than the one-factor model (Cheung & Rensvold, 2002), suggesting that these constructs are distinct and our measures have construct validity.

Moreover, we also performed the more formal test of discriminant validity recommended by Fornell and Larcker (1981). The ICR values were 0.924 for team role clarity and 0.89 for implicit coordination. The AVE values were 0.72 for team role clarity and 0.53 for implicit coordination. All ICR and AVE values meet the recommended threshold values (Fornell & Larcker, 1981).

Insert Table 1 about here

Descriptive Statistics

Table 2 presents the means, standard deviations, Cronbach's alphas, and correlations of the variables. It shows that task knowledge diversity was not significantly correlated with team performance (r = -0.03, n.s.).

Insert Table 2 about here

Hypothesis Testing

Table 3 presents the results of the regression analyses used to test our hypotheses. As

suggested by Aiken and West (1991), we examined the moderating effect of team role clarity by regressing team performance on task knowledge diversity × team role clarity (Model 2). The results indicated that the interaction term of team role clarity and task knowledge diversity had a positive and significant effect ($B = 465.62$, $p < 0.01$) on team performance. We examined the moderating effect of implicit coordination by regressing team performance on task knowledge diversity × implicit coordination (Model 3). The results indicated that the interaction term of implicit coordination and task knowledge diversity had a positive and significant effect ($B = 448.20$, $p < 0.01$) on team performance. These results provided supports for Hypothesis 1 and Hypothesis 2.

Hypothesis 3 was tested by regressing team performance on task knowledge diversity × team role clarity × implicit coordination (Model 4). The results indicated that the three-way interaction term of task knowledge diversity, implicit coordination, and team role clarity exerted a significant effect on team performance ($B = 653.43$, $p < 0.05$).

As shown in Figure 2, the relationship between task knowledge diversity and team performance was positive when team role clarity was high, but was negative when team role clarity was low. Similarly, Figure 3 shows that task knowledge diversity was positively related to team performance when implicit coordination was high, but was negatively related to team performance when implicit coordination was low. Thus, Hypotheses 1 and 2 received supported.

To facilitate the interpretation of the three-way interaction effect, we plotted it following the procedure recommended by Preacher et al. (2006), as shown in Figure 4. The simple slope tests indicated that the relationship between task knowledge diversity and team performance was positive and significant ($p < 0.05$) when team role clarity and implicit coordination are both high, while the other three slopes were non-significant. Therefore, Hypothesis 3 was supported by the results of the regression and the simple slope tests.

We further examined the differences among the slopes with the slope difference test for three-way interactions in multiple linear regressions of Dawson and Richter (2006). The rising slope between task knowledge diversity and team performance under high team role clarity and implicit coordination differed significantly from the negative slope under low team role clarity and low implicit coordination (t=2.58, p=0.01) but not from the slope under low team role clarity and high implicit coordination (t=1.57, p=0.12) or high team role clarity and low implicit coordination (t=1.405, p=0.16). Thus, we found partial support for Hypothesis 3.

Insert Table 3 and Figures 2, 3, and 4 about here

Discussion

Theoretical Implications

Our study makes theoretical contributions to the task knowledge diversity and role clarity literatures. First, information/decision-making theory conceptualizes a team's diverse task knowledge as a repository (Kristinsson et al., 2016). Thus, researchers have focused on comparing teams with large task knowledge pools with teams with small task knowledge pools (e.g. Bell et al., 2011; Cox & Stacy, 1991; Williams & O'Reilly, 1998). However, this approach treats task knowledge diversity as static, and it fails to consider that diverse individual task knowledge can be leveraged when team members learn and share task knowledge (Grand et al., 2016). We propose that understanding how diverse task knowledge is learned and shared is important for understanding the value of task knowledge diversity. Accordingly, we extend information/decision-making theory to examine how team role clarity and implicit coordination moderate the relationship between task knowledge diversity and team performance. We find that team role clarity and implicit coordination not only

moderate this relationship, they also strengthen the argument that knowledge learning and sharing can explain the link between task knowledge diversity and team performance.

Second, we demonstrate that the relationship between task knowledge diversity and team performance varies with levels of team role clarity and implicit coordination. Therefore, we identify new situational factors that explain the inconsistent results of previous studies. Specifically, our research helps to explain why some studies have found a non-significant relationship between task knowledge diversity and team performance, while other studies have found that task knowledge diversity is positively related to team performance.

Third, the CEM has been supplemented and enriched. This paper confirms that the elaboration of diverse task knowledge needs to have a specific flow direction. Not only must task knowledge to be delivered, but specific task knowledge must also be passed to specific members to promote elaboration. We propose that team role clarity and implicit coordination jointly influence the process of delivering specific task knowledge to specific members. Our findings show that teams with high team role clarity and high implicit coordination are more likely than their counterparts to share diverse task knowledge and thus improve team performance.

Fourth, this study contributes to role clarity research. The individual-level consequences of role clarity are primarily functional for the organization as a whole, but it is important to also explore the effect of role clarity within small interdependent teams (Lynn & Kalay, 2015). This study demonstrates the importance of role clarity at the team level. Role clarity has been largely discussed at the organizational level, and its importance at the team level has only recently been studied. Thus, further studies are needed.

Finally, we also contribute to the implicit coordination literature by showing that implicit coordination can affect the relationship between task knowledge diversity and team performance. Most previous studies of coordination have neglected forms of implicit

coordination (Hecker, 2011), although a few have considered the effect of implicit coordination on team performance (e.g. Rico et al., 2008). Our findings suggest that implicit coordination moderates the relationship between task knowledge diversity and team performance. Moreover, the positive interaction between implicit coordination, task knowledge diversity, and team performance indicates that teams with high implicit coordination are more likely to use diverse task knowledge to improve team performance. Importantly, our results are consistent with Grand and his colleagues' (2016) insight that team members' decisions about what task knowledge to share with other team members are extremely significant. Thus, our study enhances our understanding of the conditions under which task knowledge diversity positively influences team performance.

Managerial Implications

Achieving good team performance is not easy. Better team performance is expected to result from teams consisting of members with diverse task knowledge (Wei & Wu, 2013). However, simply recruiting members with different task knowledge may not contribute directly to better team performance. The team needs an interaction and cognition mechanism to make its teamwork effective. The results of this study show that the key to success is enabling team members to focus clearly on knowing and understanding what task knowledge is required in each team role, and anticipating the task knowledge that other team members will need.

Consequently, teams should focus on improving the level of team role clarity and implicit coordination. We propose the following suggestions for how to improve team role clarity. First, the team leader should give detailed feedback to the team members to ensure that they know what functions they are expected to perform and how well they are performing (Evans et al., 2002; Singh, 1993). In addition, a participatory style of leadership, rather than an authoritative style, contributes to high team role clarity (Mukherjee & Malhotra,

2006). The team leader should therefore encourage team members to participate actively in decision-making. Finally, team support among members further clarifies roles and leads to role clarity (Mukherjee & Malhotra, 2006), so team members should actively provide help to their colleagues.

To improve the level of implicit coordination, the team should provide some cross-training, in which team members are exposed to and practice the roles of other team members. In addition, the team should publish regular leader debriefings, that is, the team leader should brief the team members on important, up-to-the-minute elements in the task setting. Finally, maintaining a certain degree of team stability and fostering a good team atmosphere helps to foster implicit coordination within the team (Levine & Choi, 2004).

Limitations and Suggestions for Future Research

Although we believe that the present findings contribute to the diversity and team effectiveness literature, certain limitations should be considered. First, the study sample consisted of student teams, and these participants might be different from employees in real corporations. However, the participants were from different specialties and backgrounds, and the final team performance was objectively measured by the computer system, not by team members, which to some extent ensures the objectivity and accuracy of the data. Student teams have also been used in many studies related to team performance (e.g. Derue & Morgeson, 2007; Pieterse et al., 2013). Even so, further studies of task knowledge diversity and team performance in real workgroups are still needed.

The second limitation of the current study pertains to the lack of mediating variables. In our reasoning about the relationship between task knowledge diversity and team performance, we argue that the benefits of task knowledge diversity can be leveraged when diverse task knowledge is learned and shared. Although this is in line with the essence of teamwork (Cohen & Bailey, 1997) and is supported by the results of the moderate effect, we were

unable to directly capture the learning and sharing of task knowledge in this study. It would be valuable to explore the mechanism of learning and sharing among team members more deeply in future research. Moreover, team knowledge processing includes different strategies in addition to learning and sharing, such as participation, dialogue, and knowledge seeking (Clark & Anand, 2000). Thus, we hope that future research can explore the link between task knowledge diversity and team outcomes by focusing on multiple team knowledge processing.

Additionally, another potentially interesting moderator would be the motivation of team members for seeking diverse information. Hinsz and Ployhart (1998) emphasized that an individual's attempts to attain task outcomes results from his/her motivation to attain those outcomes, which reminds us to consider the motivation that team members hold to seek and share knowledge. As such, we hope to see that future research examines the influence of team members' diverse motivation (e.g., prosocial motivation, intrinsic motivation, and extrinsic motivation or autonomy, skill variety, task variety and significance) (Grant & Berry, 2011; Humphrey et al., 2007) on team knowledge processing.

Finally, our findings are consistent with our theoretical contention that task knowledge diversity has a positive effect on team performance when either team role clarity or implicit coordination is high. We expected that the strongest positive effect of task knowledge diversity on team performance would be when team role clarity and implicit coordination are both high. However, the joint moderating effect of team role clarity and implicit coordination was partially manifested as expected. Future research should explore this possibility—with a larger sample size—because we may have lacked sufficient statistical power for detecting three-way interactions (Byron et al., 2018).

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Tables and Figures

Table 1

Results of CFA

Model	χ^2	df	CFI	RMSEA
Two-factor model	212.10	64	.96	.08
One-factor model	510.67	65	.88	.14

Table 2

Descriptive statistics and correlations

Variable	Mean	SD	1	2	3	4	5
1 Team Size	5.42	0.71					
2 Gender Diversity	0.34	0.17	.19				
3 Task Knowledge Diversity	0.64	0.10	.18	-.10			
4 Team Role Clarity	4.33	0.45	.55**	.07	.07	(.97)	
5 Implicit Coordination	4.34	0.43	.46**	.03	-.00	.84**	(.90)
6 Team Performance	126.60	59.23	.23	-.08	-.03	.40**	.41**

Note. N = 62. *p < .05. **p < .01.

Table 3

Results of regression analyses

Variable	Team performance			
	Model 1	Model 2	Model 3	Model 4
Team Size	22.52*	4.42	2.98	6.05
Gender Diversity	-50.25	-11.48	-12.04	-18.31
Task Knowledge Diversity	-51.53	-25.85	-33.39	-95.62
Team Role Clarity		69.27**		45.44
Implicit Coordination			70.47**	33.44
Task Knowledge Diversity × Team Role Clarity		465.62**		240.05
Task Knowledge Diversity × Implicit Coordination			448.20**	249.40
Team Role Clarity × Implicit Coordination				101.22*
Task Knowledge Diversity × Team Role Clarity × Implicit Coordination				653.43*
R_2	.08	.29	.29	.41
F	1.58	4.67**	4.65**	3.98**

Note. N = 62. *p < .05. **p < .01.

Figure 1

The conceptual model

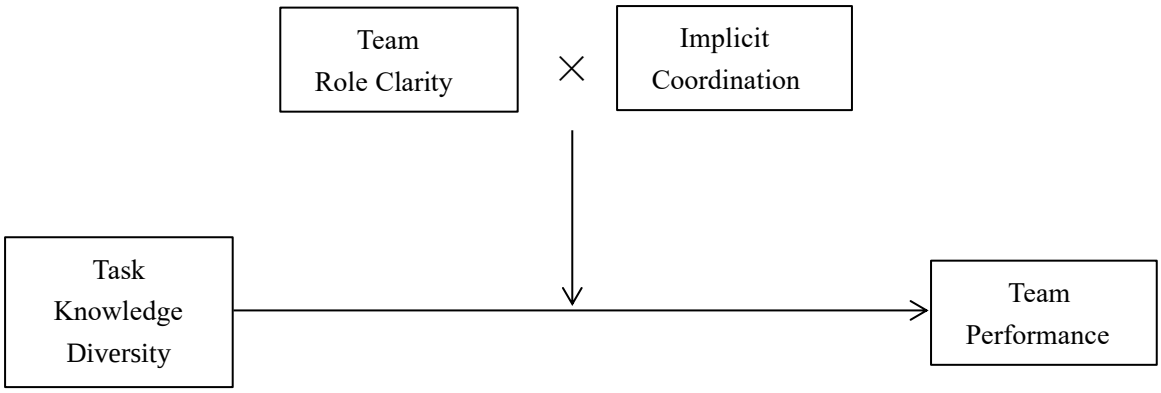


Figure2

The two-way interaction effect

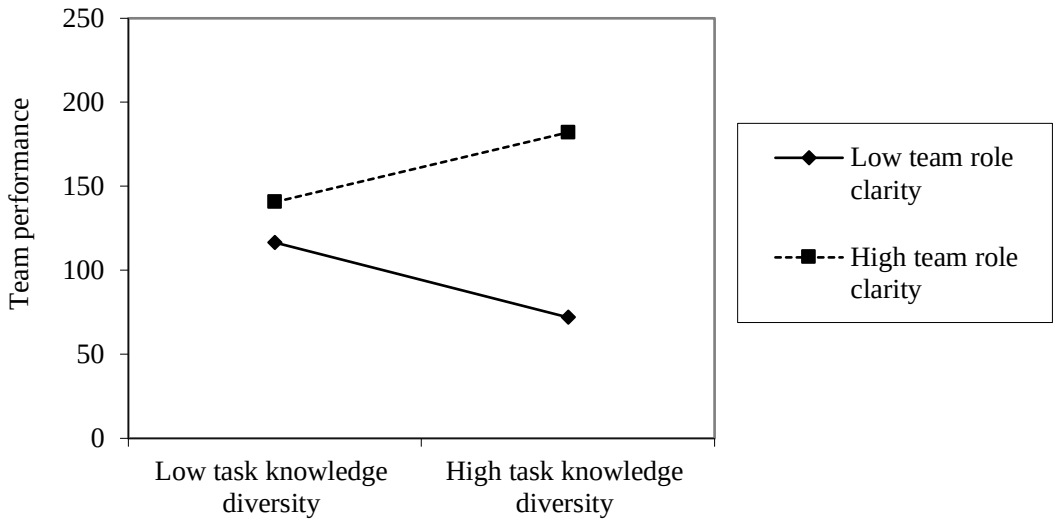


Figure3

The two-way interaction effect

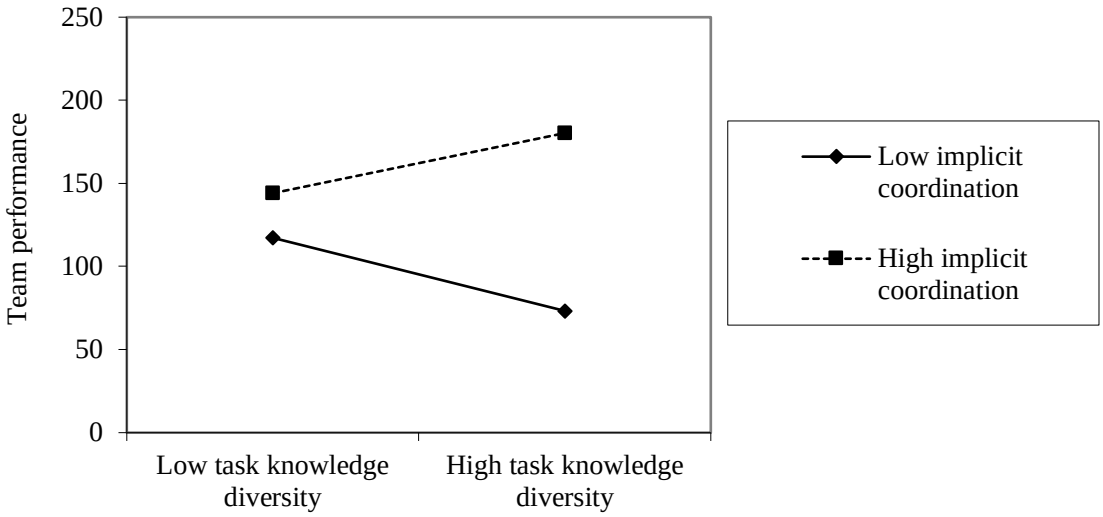
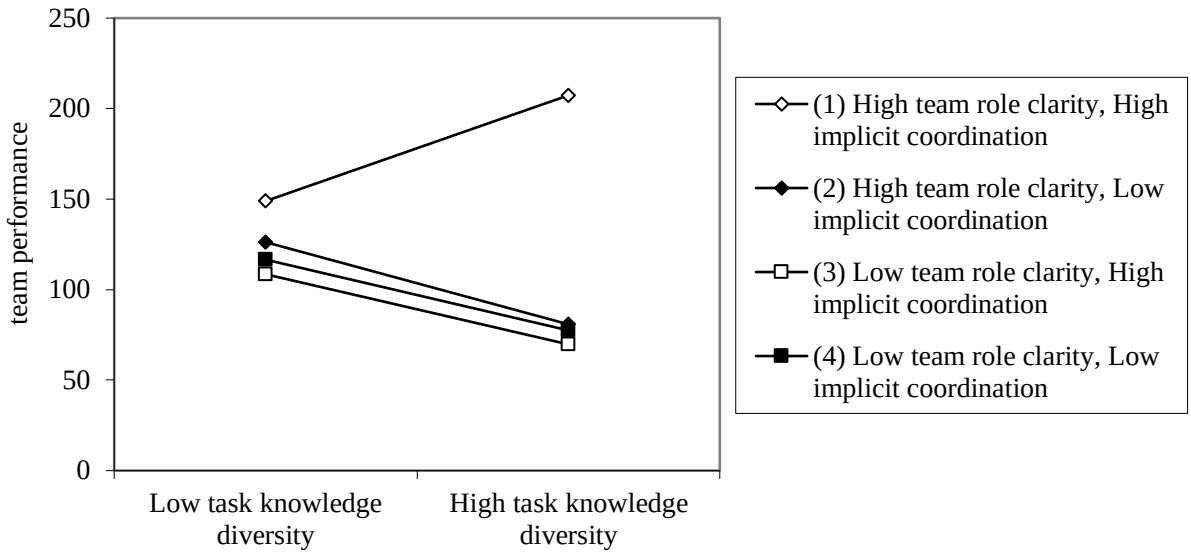


Figure4

The three-way interaction effect



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