External Learning Activities and Employee Creativity in Chinese R&D Teams

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Abstract

Team learning has drawn great attention these years. However, internal learning is not enough for team successes. Team external learning also plays an important role in management. This paper develops and tests a cross-level model of team external learning, integrating leader external learning, team internal learning and employee creativity. Combining academic areas of team learning, boundary spanning, creativity and leadership, the paper hypothesizes that (1) leader external learning positively influences team external learning, (2) team external learning leads to employee creativity, and (3) team internal learning moderates the relationship between team external learning and employee creativity. Results of analysis on a sample of 80 R&D teams comprising 331 employees from 3 medium-sized Chinese high-tech companies support hypothesis 2 and 3, but not hypothesis 1. In addition, leader external learning is found to positively influence employee creativity.

Keywords: team learning; team external learning; team internal learning; leader external learning; creativity; open innovation; R&D teams; Chinese culture

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1. Introduction

As firms rely increasingly on teams in a highly dynamic and competitive environment, most, if not all, organizations are using certain types of team-oriented work (e.g., Senge 1995; Ancona, Bresman and Kaeufer 2002; Kozlowski and Ilgen 2006).Scholars have been documenting and analyzing the trend these years, with "an explosion of work" (Mathieu, Maynard, Rapp and Gilson, 2008: 411) on teams in research. One area that has drawn great attention is team learning activities, which appear to be one of the critical performance-driven factors that can enhance competitive advantages for organizations and teams(e.g., Edmondson 1999;Bunderson and Sutcliffe 2003).

Edmondson (1999) conceptualized team learning as "an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of results" (p. 353). A growing literature has expanded academic thinking about team learning following up her seminal work. Until recently, literature of team learning has focused mainly on internal learning activities, and has confirmed the positive impact of internal learning on team performance (e.g., Bunderson and Sutcliffe 2003; Gibson and Vermeulen 2003; Cooper and Watson, 2011; Vora and Markóczy 2012).

However, internal learning is not enough for team successes. Teams are increasingly involved in carrying on complex cross-functional works and bridging disconnected parties to create and transfer valuable knowledge and information (Ancona and Caldwell 1992). If team members were restricted into team internal processes, dominated by internal operation, and hardly motivated to seek external help, the teams would confront enormous risks. As Bresman (2010) pointed out, this requires team to learn intensively, effectively and rapidly, and to turn to boundary spanning in search of external sources to learn from rather than depending only on own knowledge and experiences, especially in the environment of time pressure, lack of knowledge, changing circumstances, and resource scarcity.

Besides team learning theory, boundary spanning theory is another driving force of research on team external learning. Traditional literature regarded team as a close system, and all activities were constrained within the boundary. However, scholars realized most teams did not have all the necessary resources and support they need to accomplish more and more complex tasks, so open system philosophy without boundary limits became more and more popular (Scott 1998). Based on open system philosophy, boundary spanner scholars found that external interactions could directly benefit team effectiveness and organization effectiveness (Marrone, Tesluk and Carson 2007).

Extending the lines of team learning theory and team boundary spanning theory, the current paper seeks to further examine team external learning, particularly focusing on how leader external learning behavior affects team external learning, as well as the influence of team external learning on employee creativity in Chinese R&D teams and team internal learning as a moderator. With such an investigation, the paper makes contributions by bringing the idea of leader external learning to the forefront of team learning and boundary spanning research, making an explicit explanation to the interaction of team external and internal learning, adding cultural elements to extant related literature, and extending the research level through a cross-level design.

Marrone (2010) suggests that future research on additional outcomes of team boundary spanning should move to member level. Considering individual creativity is the building block for

organizational innovation and performance (Amabile 1988), and considering cross-level approach has been highlighted as one of the most important avenues for future creativity research (Zhou and Shalley 2008), linking team external learning with employee creativity is of theoretical significance for both team boundary spanning and creativity literature.

The research setting of our study is R&D teams in high technology companies. R&D teams have been characterized by team learning, or collective learning, and have been extensively identified as learning tools for companies, constituting paramount spaces for learning, experiments and knowledge creation (Bourgeon 2007). External learning is especially important for R&D teams, which initiate the concept development of the new product with input of "voice of customers" (Kim and Kim 2009), and are characterized by non-routine tasks with high level of complexity and uncertainty. (Bourgeon 2007; Ancona and Caldwell 1992). The sample of Ancona and Caldwell's (1992) seminal study on team external activities was R&D teams. As they described, R&D teams depend on external environment for information, resources, and support and must deliver products and services to others. In summary, R&D teams provide a perfect context for our research.

In the following, the paper begins by reviewing the literature on team external learning, and identifying the relationships among leader external learning, team external learning, team internal learning and employee creativity. The paper develops a series of specific hypotheses linking these variables and proposes a theoretical model with team external learning activities in the center. The paper goes on to test the model using survey data obtained from a field sample of 80 R&D teams in 3 high-tech companies in China. The results section of the paper examines the hypotheses we put forward. Then, in the discussion section, Chinese context is highlighted in the analysis on the relationship between leader external learning and team external learning, and implications of the research results for theory and practice are discussed. At the end, the paper concludes with several limitations of the study and directions for future research.

2. Theoretical Background and Hypotheses

2.1 Leader External Learning and Team External Learning

In her classic paper on team learning and psychological safety, Edmondson (1999) developed a team learning scale with 7 items, but she used it as one-dimension construct, rather than distinguished between internal learning and external learning. That was why external learning scholars did not adopt her one-dimension scale in their researches. It was Argote et al. (2001) and Wong (2004) who classified team learning into internal learning and external learning, or local learning and distal learning as Wong (2004) labeled. According to Wong's definition, distal learning (or external learning) is group learning that occurs with individuals external to the group, while local learning (or internal learning) is group learning that takes place with individuals in the immediate group (Wong 2004).

Bresman (2010) further proposed and tested a model that consisted of two sets of external learning behaviors: contextual learning and vicarious learning. Contextual learning activities allowed a team to learn from external sources about pivotal aspects of its context, and vicarious learning allowed a team to learn from others with prior or concurrent similar experiences about pivotal aspects of its task. So contextual learning was related to environment, and vicarious learning was related to task. His study in pharmaceutical R&D teams supported his dichotomous classification of team external learning. In our paper, we did not distinguish between contextual and vicarious learning as Bresman (2010) did. Instead, we regarded external learning as a construct

similar to scouting activities, which is in line with Wong's (2004) and Ancona & Caldwell's (1992) researches.

Wong (2004) found that team cohesion leads to team external learning. Except for this finding, past research has paid little attention to the antecedents of external learning specifically. However, team learning and boundary spanning literature provide valuable hints on the predictors of external learning. Edmondson (1999) found that psychological safety was the strongest driven factor of team learning, because team with high psychological safety would take on more interpersonal risks and challenges related to externally oriented behaviors. In her literature review, Marrone (2010) noted that team leadership, team composition and some other team characteristics (like group identification) are team level predictors of boundary spanning activities.

Both team learning and boundary spanning literature have explored team leader's impact. As Edmondson (1999) pointed out, "a team leader's behavior is particularly salient" for team learning (p. 356). Team leader has been widely recognized as a pivotal role for R&D projects by coordinating, planning, conflict solving and other aspects of project management (Aronson et al.2008; Sarin and O'Connor 2009; Odusami et al. 2003). As suggested by Yukl (2009), leaders could enhance team learning by "encouraging the use of procedures that increase creative ideas, nurturing promising ideas, obtaining resources, encouraging members to experiment with new approaches, using after-activity reviews, and monitoring external events that are relevant to innovative activities by the team."(p. 51)

Extant research on the relationship between leadership and team learning involved nearly every aspect of leaders, such as leaders' signals of driving team learning activities (Garvin, Edmondson and Gino 2008), team leader characteristics (Sarin and McDermott 2003), leadership values (Wong, Tjosvold and Lu 2010), coach (Edmondson, 1999), self-and shared leadership (Bligh, Pearce and Kohles 2006) and so on, surprisingly missing the aspect of leader learning activities per se. We believe that leader external learning is a potential predictor of team external learning due to the following considerations:

In a literature review about leadership in R&D organizations, Elkins and Keller (2003) also summarized that boundary spanning activity by the leader was found to be important factors for project success. Project leaders' boundary spanning activities were found to have positive relationship with team outcomes (Brion, et al. 2012). Among their results, project leaders' activities of "scanning for information and ideas" positively influencing team knowledge acquisition is of great relevance to our study. Druskat and Wheeler's (2003) case study in manufacturing background revealed that most successful team leaders engaged externally focused behaviors consistently, like social and political awareness, seeking information from outside parties, obtaining external support. The impact of leader boundary spanning behavior on team boundary spanning was not addressed in their paper. In Joshi, Pandey and Han's (2009) theoretical paper, they mentioned directly that "team leaders' boundary spanning activity is positively associated with the team's boundary spanning" (p.745).

In their paper on team external learning behaviors, Ancona and Caldwell (1992) found that team leaders had to take the responsibilities to acquire knowledge, information, resource and support for teams. In this sense, leader external learning is highly important, especially for team external learning, because the new knowledge and new ideas acquired from external sources by leaders may stimulate employees' thinking, broaden their horizons, and in turn inspire them to further efforts to seek more knowledge, feedback and information. In addition, more importantly, according to social

learning theory (Bandura1977), one crucial way team members learn how to behave is by observing and modeling the behavior of salient others. As "salient others" in teams, leaders are role models who influence team members significantly through their own behaviors. So when leaders exhibit more external learning activities, team members might identify and recognize these activities. Being enlightened and motivated, they would follow and echo the role models' behaviors, showing more external learning activities themselves. The continuous exemplary behaviors from leaders intensify team members' imitation behaviors repeatedly, and gradually become a kind of basic standard for team external learning. During the process, team members' cognitions and behaviors about external learning are shaped and established. Thus, the literature and research above combine to form the basis for the following hypothesis:

Hypothesis 1: Leader external learning is positively associated with team external learning.

2.2 Team External Learning and Employee Creativity
Creativity is defined as employees' generation of novel and useful ideas concerning products, procedures, and processes at work (Hirst, Knippenberg and Zhou 2009).As the building block and important source of organizational and team innovation (Amabile 1988, 1996), employee creativity has been increasingly sought by organization and teams.

As creativity is involved with the generation of novel products, processes and so on, new knowledge, new information and new skills are needed for employees, so they have to learn to achieve their goals. According to Amabile's (1996) componential theory of creativity, what they learn provide them with important knowledge and necessary information for their creativity. Driven by the assumption that employee creativity is related to learning, researchers have devoted considerable attention to identifying the predictors of creativity in management learning area. For example, employee learning orientation was confirmed as an important antecedent of employee creativity (Gong, Huang and Farh 2009 ; Hirst, Knippenberg and Zhou2009; Hirst, Knippenberg, Chen and Sacramento 2011). Hirst, Knippenberg and Zhou (2009) found team learning positively moderated the relationship between employee goal orientation and creativity. At the team level, Gino et al. (2010) found creativity was high when team could learn from direct and indirect experience. To date, there have been few, if any, attempts to examine how team learning directly influences employee creativity using cross-level analysis, especially how team external learning relates to employee creativity.

We address the gap by exploring the cross-level relationship between team external learning and employee creativity. Inevitably, team creativity/innovation is involved in our reasoning process. Pirola-Merlo and Mann (2004) proved that team creativity was positively correlated to individual creativity, and they believed that team creativity was the aggregation of individual members' creativity over time. Thus, the degree of team creativity is an indicator for team member creativity.

However, team creativity alone is not enough to estimate individual creativity, because basically team creativity and team member creativity are two different types of creativity. As Pirola-Merlo and Mann (2004) noted, creativity could take place as members make efforts separately on components of large projects, and could also take place when they interact, share and communicate. Team processes may inspire creative ideas among team members, but most creative ideas may originate from particular members. In their longitudinal study, they found team creativity is influenced and partly determined by individual creativity (Pirola-Merlo and Mann 2004).That is

why we are more interested in the cross-level relationship between team external learning and employee creativity, rather than the same-level relationship between external learning and team creativity.

Bresman (2010) indicated that team external learning could help teams to change existing routines, and empirically confirmed that external learning was beneficial to improving team performance. Wong (2004) found team internal learning could increase team efficiency, and team external learning could enhance team creativity/innovation, which was an indicator of employee creativity as discussed above. Team external learning enhances employee creativity through the following three mechanisms. First, external learning provide team members with more channels to acquire novel information, novel knowledge and novel skills from external sources (Ancona and Caldwell 1992). Individuals in the same social circle tend to have similar knowledge, while individuals outside the immediate circle tend to posses different knowledge (Granovetter 1983). Thus, employees can be expected to have more diverse and new knowledge and skills if teams provide more channels to connect with outside actors. Second, team members could be inspired by novel ideas and information to self-reflect and self-develop due to the awareness of their own insufficiencies, and be stimulated to combine different knowledge to create innovative solution (Sutton and Hargadon1996). Third, by learning from others who already have prior experiences, team members could avoid repeating mistakes and reinventing practices, and bypass unnecessary steps (Bresman 2010). Therefore, we hypothesize that:

Hypothesis 2:   team external learning is positively associated with employee creativity.

We propose that team internal learning and external learning are complimentary to one another to enhance individual creativity. Higher level of external learning can lead to higher employee creativity and team innovation. However, as Sutton and Hargadon's (1996) suggested, team members also have to actively engage in internal learning to decide how external information and knowledge can be integrated to create an innovative solution for team work and individual work. Examples of internal learning activities include sharing information, seeking feedback, asking for help, talking about errors, and experimenting (Edmondson 1999). It is through these activities that team members can reach an agreement on current situation and future direction, improve their collective understanding of specific knowledge or information, realize potential risks, and determine proper action plans. Teams are likely to need these internal learning activities so as to apply external ideas to produce novel solutions and enhance the possibility of employees making correct decisions on their creative work.

To date, mixed results have been found in empirical researches on the effect of interaction of team internal learning and external learning. Wong (2004) did not found the significant moderating effect of team internal learning on the relationship between team external learning and team innovation as expected. While in Bresman's (2010) study, team external learning was more strongly associated with team performance when a team engaged in more internal learning activities. Argote and Miron-Spektor (2011) mentioned the two papers in their literature review on organizational learning specifically, and pointed out that understanding when different types of learning were complements or substitutes for one other would become one important topic for future researches.

We believe that different types of the team samples in the above two studies might be a significant reason for the gap. The 78 teams participating in Wong's (2004) research were from a

financial services firm, a hospital, a diversified industrial firm and a high-technology firm respectively, ranging from functional to cross-functional teams and from new product development to manufacturing teams, while the 62 teams participating in Bresman's (2010) study were all from drug development departments of six large pharmaceutical firms. R&D teamwork is characterized as a cooperative human problem-solving process (Liao 2008), which means internal learning is of great significance as well. That explains why Bourgeon (2007) pointed out that R&D teams should engage in consultations with both internal and external actors. Ancona, Bresman and Kaeufer (2002) noted that teams such as those working in product design and other R&D types must directly interface with important stakeholders both within and outside of their organization. Internal learning is even more important for R&D teams due to environment uncertainty, task complexity and so much information being introduced from outside. R&D team members have to process novel information and knowledge efficiently, to make decision quickly and to upgrade their innovation abilities continuously through internal learning processes to accomplish individual tasks and enhance creativity. Other types of teams may not need simultaneous internal learning and external learning as intensely as R&D team does. Given that R&D teams are research sample in our study, we propose the following hypothesis:

Hypothesis 3: team external learning is more strongly associated with employee creativity when a team engages more internal learning activities in R&D teams.

Insert Figure 1 about here

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3. Method

3.1 Sample

The research setting of our study is R&D teams in high technology companies. R&D teams have been characterized by team learning, or collective learning, and have been extensively identified as learning tools for companies, constituting paramount spaces for learning, experiments and knowledge creation (Bourgeon 2007). External learning is especially important for R&D teams, which initiate the concept development of the new product with input of "voice of customers" (Kim and Kim 2009), and are characterized by non-routine tasks with high level of complexity and uncertainty. (Bourgeon 2007; Ancona and Caldwell 1992). The sample of Ancona and Caldwell's (1992) seminal study on team external activities was R&D teams. As they described, R&D teams depend on external environment for information, resources, and support and must deliver products and services to others. In summary, R&D teams provide a perfect context for our research.

To test our hypotheses, we collected data from R&D teams in 3 medium-sized Chinese high technology companies located in Beijing and Shanghai, mainly focusing on information technology. With the help of HR department of the companies, we identified 206 R&D team leaders and 977 team members. We asked team leaders to evaluate their own learning behaviors, and then asked

them to randomly select more than 3 immediate subordinates, and evaluate their creativity one by one. After interacting with team leaders, we asked the subordinates who were selected by the leaders to rate their own team learning behaviors. Before the evaluation, we assured clearly that the purpose of this survey was for academic research, and their answers were highly confidential to reduce possible bias because respondents might not feel safe completing a questionnaire which was not anonymous. All the questionnaires were returned to us directly, instead of HR departments, and were read only by researchers. For those who had no time to fill in the questionnaires on the spot, we provided electronic version of the questionnaire through emails, and made follow-up phone calls to ensure adequate response rate.

133 responses from leaders and 579 responses from employees were received, yielding response rates of 64.6% and 59.2%. After matching the responses of employees and those of leaders, the final sample consisted of 331 employees and 80 team leaders. Effective rates were 60.2% and 57.2% for employees and leaders, respectively. Among teams, 60.2% of the sample had 6 to 10 employees. Of the 331 employees, 75.2% were male, 64.7% were among 26-35 year olds, 47.1% had been working for 4-6 years, and 45.6% held bachelor's degrees. Statistics of the sample are shown in detail in Table 1.

Insert Table I about here

3.2 Measures

All variables in our study were measured by established instruments. Team external learning, team internal learning and leader external learning were scored on a 6-point Likert response scale (1 = "strongly disagree" to 6 = "strongly agree") and employee creativity was scored on a 5-point Likert response scale (1 = "strongly disagree" to 6 = "strongly agree"). High scores represent greater standing on the variable of interest. We did a pilot test to check the clarity of the items. A sample of 26 employees of another organization who was not part of this research completed the questionnaire. The data collected from this pre-test were reviewed, and only minor modifications were needed as the results indicated.

3.2.1 Team external learning and leader external learning. We assessed team external learning by using the 4-item measure firstly applied by Wong (2004), who adapted this measure from Ancona and Caldwell's (1992) external activity scale. Examples of such items are: "Our team seeks ideas/expertise from people external to the team" and "our team obtains help or advice from people external to the team." The measure was rated by employees in our study. Leader external learning was also assessed by the same scale, changing the subject from "our team" to "I", and rated by team leaders themselves. The Cronbach's alphas for the measures were 0.90 and 0.70, respectively.

3.2.2 Team internal learning. The 4-item measure of internal learning was firstly used by Bresman (2010), who adapted this measure from Edmondson's (1999) team learning scale. Sample items are: "We take time to figure out ways to improve the work processes" and "we identify new information leading to changes." The measure was rated by employees in our study. The Cronbach"s alpha for this measure was 0.85.

3.2.3 Employee creativity. A 4-item scale was used to measure employee creativity in our study. The scale was developed by Farmer, Tierney and Kung-McIntyre (2003), who used and tested the scale in Chinese context, and confirmed that the scale taps actions perceived by respondents to reflect the Chinese view of employee creativity. The measure was rated by team leaders. Sample items included "He or she tries new ideas or methods first" and "he or she generates ground breaking ideas related to the field." The Cronbach's alpha for this measure was 0.94.

3.2.4 Control variables. We controlled for variables of gender, age, tenure, education at individual level and team size at team level that comparable studies have found may influence team learning and employee creativity (Ancona and Caldwell 1992; Edmondson 1999; Hirst, Knippenberg and Zhou 2009). In order to protect respondents' privacy, we did not ask them to report their exact age and other information. Instead, we asked respondents to indicate their demographic information in one of certain numbers of categories. Among them, gender was measured as a dichotomous variable (i.e., 1 = male, 2 = female). For age, 1= "25 years old or below"; 2= "26-35"; 3= "36-45"; 4= "46 or above". For team tenure, 1="1 year or below"; 2= "1-3"; 3= "4-6"; 4= "7-9"; 5= "10 or above". For education, 1= "below bachelor's degree"; 2= "bachelor"; 3= "master"; 4= "doctor". Team size is a count of member in the team, with 1= "5 persons or below"; 2= "6-10"; 3= "11-20"; 4= "21-40"; 5= "40 or above".

3.3 Preliminary analysis

Our study includes individual and team level constructs. To validate the data structure, we examined whether the data empirically justified aggregation of team external learning and internal learning. The mean R_{wg} across teams of .86 for external learning, and .89 for internal learning suggest adequate within-team agreement (James, Demaree, & Wolf, 1984). Further, Intraclass correlation coefficients for external learning (ICC1=.176 and ICC2=.46) and internal learning (ICC1=.30 and ICC2=.63) are also satisfactory (James, Demaree, & Wolf, 1984), with the exception that ICC2 of external learning is slightly less than 0.5. But with high R_{wg} and theoretical support, we continue with the analyses as Chen and Bliese (2002) suggested. Results of one-way ANOVA for the scale is significant (F=1.902, P<0.001), also supporting the aggregation of team external learning.

External learning and internal learning scales have never been used in Chinese context before, so measures were translated into Chinese by a management professor and a doctoral student by following translation-back translation procedures (Brislin 1980), and the translated surveys were reviewed and checked by another professor fluent in both English and Chinese. The process was repeated until convergence was achieved. Results of the EFA revealed clear one-factor structure for external learning and internal learning respectively, and the factor loadings of all items were greater than 0.60. We performed confirmatory factor analysis (CFA) on the 2 constructs of team external learning and internal learning. The fit of the model with 2 factors loading separately (χ^2 =85.623, df = 19, RMSEA = 0.10, CFI = 0.944, NFI =0.934) is better than 1 factor model collapsing the two learning behaviors into one (χ^2 =159.941, df = 20, RMSEA = 0.19, CFI = 0.857, NFI =0 .866), confirming the discriminant validity of the two measures.

3.4 Results

Insert Table II and Table III about here

Table 2 and 3 display the means, standard deviations, and correlations for all of the key variables at individual and team level respectively. Table 4 summarizes all hypotheses results. Hypothesis 1 posited a direct positive relationship between leader and team external learning activities. Both leader external learning and team external learning are at team level, so hypothesis 1 was tested by using hierarchical regression analyses. As presented in Model 2 of table 3, leader external learning is not significantly related to team external learning (β= .17, ns), not supporting hypothesis 1.

Insert Table IV about here

Hypothesis 2 and 3 involve cross level variables, and were tested by using hierarchical linear modeling. We entered the variables into the regression analysis in four steps: the control variables (Model 3) were entered first, followed by the independent variable (team external learning, Model 5), and the moderator (team internal learning, Model 6), then, the interaction was entered at the end (Model 6).Hypothesis 2 posited predicting effect of team external learning on employee creativity. Model 5 in Table 3 reveals that team external learning was positively associated with employee creativity(γ= .39, p< .01),lending support to hypothesis 2.

Hypothesis 3 concerned the moderating role of team internal learning in the relationship between team external learning and employee creativity. As displayed in Model 7, the interaction of team external learning and internal learning was positively related to employee creativity (γ= .06, p< .01).Hypothesis 3 was supported. We plotted the interaction according to Aiken and West's (1991) procedure of computing slopes one standard deviation above and below the mean of the moderating variable. Figure 2 presents the interaction pattern. As shown in Figure 2, team external learning was more positively associated with employee creativity when team internal learning is high.

Insert Figure 2 about here

Leader external learning is positively related to employee creativity (γ= .25, p< .01), as shown in Model 4 of Table 3. Considering the core research questions are involved in the construct of team external learning, the relationship between leader external learning and employee creativity is not

postulated as an independent hypothesis in our study. However, the finding may still have theoretical and practical value as discussed in the following section.

4. Discussion

4.1 Chinese context

There was unexpected result for our hypotheses about the relationships between leader external learning and team external learning behaviors. Specifically, contrary to hypothesis 1, we found that leader external learning has no significant influence on team external learning. This result was not in line with those of Ancona and Caldwell (1992), Faraj and Yan (2009) and Brion et al. (2012). Considering that development of hypothesis 1 was based on theorizing and findings in western countries, we believe Chinese context should account for the new result of our study (Gutierrez, Spencer and Zhu, 2012; Zagorsek, Jaklic, and Stough, 2004).

China is a society of high power distance (Hofstede 1991), that has also been empirically proved in Chinese R&D setting (Zhang and Begley 2011a).Leaders with high power distance orientation tend to make full use of power and control subordinates through power. In reality, to emphasize their own power and status, leaders who concentrate on external learning behaviors may purposely restrict subordinates' learning behaviors, especially external learning behaviors, to maintain information and knowledge asymmetry, because certain information and knowledge are significant source of leadership power (Hickson et al. 1971; Pettigrew 1972). In addition, high level of external learning of leaders does not assure their demanding requirements on subordinates' external learning. Instead, considering the time and energy constraints, leaders may be oblivious to team external learning because they spend too much time and energy to their own learning behaviors.

Chinese culture was described as a context discouraging creativity before, but as Gardner (1989) noted, Chinese societies actually strongly value creative activities that are useful and pragmatic. In this sense, creativity is no big of difference in Chinese and western culture. The core elements of creativity we adopt in current paper are novelty and practice, which are paramount and common in both east and west societies in essence (Farmer, Tierney and Kung-McIntyre 2003).Therefore, we believe that the confirmed mechanism connecting team external learning, team internal learning and employee creativity in our study would also be applicable in western culture.

4.2 Theoretical contributions and managerial implications

Combining fields of team learning, boundary spanning, creativity and leadership, our study addresses the following questions, and provides further insights to the area of team external learning: First, what is the cross level relationship between team external learning and employee creativity? Extant researches on external learning mainly focus on team level outcomes and mechanisms (e.g., Wong 2004; Bresman 2010). Individual level outcomes should be considered in this area. We point out that individual creativity and team creativity are two type of creativity, and individual creativity might be an important outcome variable for team external learning. Responding to the call to do more multilevel research on creativity and boundary spanning (Zhou and Shalley 2008; Marrone 2010), our empirical study validates that team external learning positively influences employ creativity.

Second, is internal learning a moderator on the relationship between team external learning and employee creativity in R&D project teams? Boundary spanning teams always face challenges balancing internal and external team processes (e.g., Choi 2002). In team learning literature, mixed

results have been found on the effect of the interplay of team external and internal learning (Wong 2004; Bresman 2010). We found that the types of sample teams in Wong's (2004) and Bresman's (2010) researches were different, and postulated that the type of team might one of reasons to account for the mixed findings. Our study reveals that in R&D project teams, internal learning and external learning are complimentary to each other, paralleling Bresman's research (2010) in drug development teams. Considering that more and more other types of teams are facing similar uncertain and complex environment and empowered to make their own decisions (Zhang and Bartol 2010), we believe that other types of teams could learn from our conclusion to some extent.

Third, is leader external learning behavior one of antecedents of team external learning? Extant literature focuses largely on the impact of external learning activities (Wong 2004; Bresman 2010), but only a few examines what influence external learning specifically. Inspired by the important role of leaders on facilitating team learning activities (e.g. Edmondson 1999), and the surprising fact that the direct relationship between leader learning behaviors and team learning behaviors was not explored before, the paper introduces leader external learning behavior into the area. Although contrary to our expectation, there are no significant relationship between leader external learning and team external learning in our study, the finding helps in better understanding the nuanced nature of antecedents to team external learning.

Fourth, is there anything unique about team external learning in Chinese culture? To date, extant empirical studies on team external learning have been conducted only in western context. However, theories developed in western culture cannot be assumed to apply in Chinese culture (Hofstede 1993). Contrary to similar western findings, our study does not find leader external learning activities significantly influence team external learning activities. We believe that the high power distance in China should account for the gap. The result helps to add different culture elements into team learning and boundary spanning theory.

Although the relationship between leader external learning and team external learning was not significant in our study, we did find that leader external learning directly influences employee creativity. The finding adds individual level outcomes to Ancona and Caldwell's (1992) and other similar conclusion that leaders' boundary spanning behaviors have positive effects, mainly on team level outcomes.

With regard to management practice, our study suggests that Chinese team leaders should not only concentrate on their own external learning activities if they expect more external learning activities from team members. For top management in Chinese R&D organizations, where team external learning is crucial for success, they should be aware that team leaders' external learning does not necessarily lead to team external learning. More direct stimulating actions should be considered to enhance team external learning. However, if their goal is to enhance employee creativity in teams, team leader external learning is also a powerful stimulator. Top managers should facilitate both leader external learning and team external learning to encourage employee creativity. In addition, R&D teams could learn from our study that they should engage in external and internal learning simultaneously to achieve high level of employee creativity, rather than focusing on one side only. For all those teams facing similar situation to R&D teams, the interaction of team internal learning and external learning should also be attached importance to enhance individual creativity.

4.3 Limitations and directions for future research
Our study is not without limitations. First, the cross-sectional design limits the extent to which

causal relations can be inferred from our study. It is also possible that employees who are more creative tend to engage in more external learning, and in turn enhance team external learning behaviors. However, it is more difficult to examine the influence of lower-level entities (e.g., individual level) on higher-level phenomena (e.g., team or organization level) because changes in higher-level phenomena take longer time to emerge (Kozlowski and Klein 2000). Future research employing a longitudinal design would be better suited to address the causal status of the variables tested in our study.

Second, the data were collected from R&D teams in 3 medium-sized Chinese IT companies. Thus it is equivocal whether the findings could generalize to other contexts. For example, considering that power distance tend to be lower in initiation stage of innovation (Nakata and Sivakumar 1996), is it still true that leader external learning has no significant effect on team external learning for Chinese start-up and small companies, or in Chinese non-R&D teams? In addition, although the arguments and results in our paper about creativity are not culture-dependent, there are findings that western culture is more positively related to employee creativity (e.g. Farmer, Tierney and Kung-McIntyre 2003). The conclusion of team internal learning being a moderator for team external learning and employee creativity needs to be further tested. Future researches extending to other contexts would help to understand more of the value of the results in this paper.

Third, results may have been affected by the fact that ICC2 value(0.469) of team external learning is marginally lower than 0.5, an often-cited cutoff point(James, Demaree and Wolf 1984). As Bliese (1998) indicated, low ICC2 values limit the ability to detect relationships of team-level variables. However, we make up the deficiency by showing satisfactory results of mean R_{wg} and one-way ANOVA of this variable. In addition, defining team external learning as a team-level construct is theoretically supported. Combined together, aggregating the construct of team external learning is still applicable (Chen and Bliese 2002).

Our research confirms what IS NOT a predictor of team external learning in Chinese context. Future research should try to examine other leadership behaviors and other stimulators, and point out what ARE the predictors of team external learning, no matter in what culture. A recent study found that organization structure at organization level and team structure at team level are predictors of team external learning and internal learning (Bresman and Zellmer-Bruhn 2012). More exploration is needed in this field. We believe that Chinese culturecould contribute more to future research in this field, since culture differences have already been found in literature on boundary spanning, learning and R&D teams(e.g., Onyemah, Rouziès and Panagopoulos 2010; Elkin, Zhang and Cone 2011; Zhang and Begley 2011b).

Although leader external learning is an antecedent of employee creativity, it is not a predictor of team external learning, which means that team external learning has no mediating effect on the relationship between leader external learning and employee creativity. We expect that goal orientation (Hirst, Knippenberg and Zhou 2009), or perceived value of creativity (Farmer, Tierney and Kung-McIntyre (2003) might play mediation role instead, but there have been no evidence for our postulation to date. Future research should incorporate more variables to account for the mechanism of leader external learning stimulating employee creativity.

The mechanism of team external learning influencing employee creativity should also be further explored in the future. The mixed findings in extant literature (Wong 2004; Bresman 2010) are discussed in our study, and the moderating effect of internal learning in R&D teams is confirmed, revealing that the type of team is a kind of boundaries for this mechanism. Hirst, Knippenberg and

Zhou (2009) found the interaction of team learning and employee goal orientation has a nonlinear and cubic relationship with employee creativity. We believe that many other variables at organization level, team level and individual level have the potential to be moderators. Additionally, mediating mechanisms connecting team learning and employee creativity need to be further explored. Examining more moderating variables and mediating variable helps in understanding the delicate nature of this cross-level mechanism.

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Table I.   Statistics Related to the Control Variables

Control variables	No. of respondents	%
1. Gender [a]		
Male	249	75.2
Female	82	24.8
2. Age[a]		
25 years old or below	57	17.2
26-35 years old	214	64.7
36-45 years old	58	17.5
46 years old or above	2	0.6

3. Tenure [a]		
1 year or below	89	26.9
1-3 years	86	26.0
4-6 years	156	47.1
7-9 years	0	0
10 years or above	0	0
4. Education[a]		
below bachelor's degree	53	16.0
Bachelor's degree	151	45.6
Master's degree	103	31.1
Doctoral degree	24	7.3
5. Team Size[b]		
5 persons or below	22	27.5
6-10 persons	49	61.2
11-20 persons	2	2.5
21-40 persons	5	6.2
40 persons or above	2	2.5

[a] $n = 331$ at individual level, rated by team members; [b] $n = 80$ at team level, rated by team leaders.

Table II.   Descriptive statistics, reliabilities, and correlations among measures at the individual level.[a]

	Mean	S.D.	1	2	3	4	5
1. Gender	1.25	.43					
2. Age	2.02	.61	-.03				
3. Team Tenure	2.20	.84	.07	.60**			
4. Education	2.30	.82	-.02	.35**	.28**		
5. Employee Creativity	3.39	.87	-.06	-.15**	-.21**	-.15**	(.92)

[a] $n = 331$ at individual level; reliabilities of the scales are noted in the diagonals. All correlations with ** are significant at $p < .01$ (two-tailed test).

Table III.   Descriptive statistics, reliabilities, and correlations among measures at the team level.[a]

	Mean	S.D.	1	2	3	4
1. Team Size	1.95	.88				
2. Leader External Learning	5.63	.65	.13	(.78)		
3. Team Internal Learning	4.89	.46	-.01	.05	(.85)	
4. Team External Learning	4.86	.48	.10	.18	.82**	(.90)

[a]$n = 80$ at team level; reliabilities of the scales are noted in the diagonals. All correlations with ** are significant at $p < .01$ (two-tailed test).

Table IV. Regression analysis results of the hypothesized model.[a]

	Team External Learning		Employee Creativity				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Level 1							
Constant			3.44***	3.45***	3.46***	3.45***	3.45**
Gender			-.03	-.03	-.03	-.03	-.03
Age			.04	.04	.04	.04	04
Team Tenure			.08	.08	.08	.08	.08
Education			.01	.01	.01	.01	.01
Level 2							
Team Size	.10	.08	-.03	-.05	-.06	-.05	-.01
Leader External Learning		.17		.25*	.20*	.23*	.23*
Team External Learning					.34**	.02	.02
Team Internal Learning						.42	.52
Team External Learning * Team							.06*
Internal Learning							
Deviance			851.57	849.50	842.33	841.64	839.76
Deviance Change (*df*)				2.07**(1)	9.24**(2)	9.93(3)**	11.81**(4)

[a] $n = 331$ at individual level, $n = 80$ at team level. * $p < .05$, ** $p < .01$, ***$p < .001$ (two-tailed).

Model 1 and Model 2 are analyzed at the team level; Model 3 to Model 7 are cross-level analyzed.
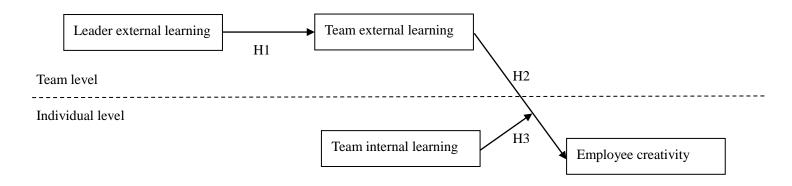
Figure 1. Hypothesized model of leader external learning, team external learning, team internal learning and employee creativity.
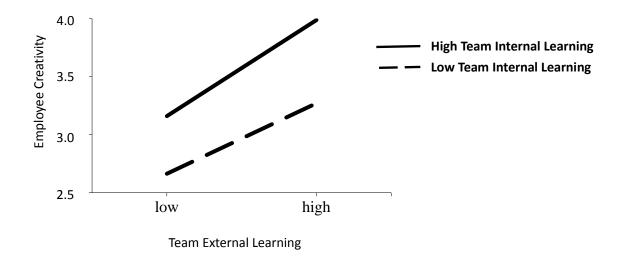
Figure 2.   Relationship between team external learning and employee creativity at high and low levels of team internal learning.