A Longitudinal and Multilevel Investigation on Factors Influencing Knowledge Sharing Behavior

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In this paper, we explore the individual-level and group-level factors influencing knowledge sharing behavior and its multi-phase influencing mechanism based on the data from 481 members and 67 groups. The result demonstrate that: (1) individual-level knowledge sharing behavior affects knowledge sharing behavior of next phase; (2) learning effect of previous phase has partial mediation effect on the relationship between the previous knowledge sharing behavior and current knowledge sharing behavior; (3) group-level knowledge sharing behavior has positive direct effect on individual-level learning effect; (4) group cohesion has positive direct effect on individual-level knowledge sharing behavior. The theoretical and practical implications of these findings are discussed finally.

INTRODUCTION

In the new economy, the organizing innovative capacity is considered to be one of the key abilities for organizational development. The process of innovation is aimed at searching for and transmitting the new technical and organizational knowledge through the circulation of knowledge creation, reserve, transfer and application (Alavi & Leidner, 2001; Nonaka, Byosiere, Borucki, & Konno, 1994). To some extent, the knowledge transfer in the organization relies on the employees' knowledge sharing behavior. Therefore, the degree of knowledge sharing behavior affects the organizing innovative ability and development ability directly. Knowledge is present in the human mind, but as the subject of knowledge sharing behavior, employees do not tend to take the initiative to sharing knowledge because of the conflicts of interest, social dilemmas and etc. Thus, how to stimulate individual knowledge sharing behavior has become the key of organizational knowledge management(H.-L. Yang & Wu, 2008).

The factors which is affected the knowledge sharing behavior have been studied from different levels and perspectives, including the cultural characteristics, environmental factors, motivational factors, interpersonal and team characteristics, individual characteristics, etc (Wang & Noe, 2010). However, most of these researches focused on a single level (He & Wei, 2009), and verified hypotheses based on the cross-sectional data, thus the results are not very much reliable and persuasive. Furthermore, such researches are very difficult to analyze the influences which the organization, team and individual factors

bring to knowledge sharing behavior in multi-levels. In fact, the knowledge sharing behavior is inevitably influenced by bound to be influenced by different factors in multi-levels because it is embedded in groups and teams. Therefore, the researches on the knowledge sharing behavior are multilevel in essence. Many scholars have pointed out the lack of multilevel research on the knowledge sharing behavior (Hsu, Ju, Yen, & Chang, 2007; Wang & Noe, 2010), and now the researchers call for more longitudinal study to complement (G. W. Bock, R. W. Zmud, Y. G. Kim, & J. N. Lee, 2005; Jiacheng, Lu, & Francesco, 2009; S.-C. Yang & Farn, 2009).

In conclusion, this study decides to adopt multi-stage and longitudinal data and hierarchical analysis method. The influence factors and process of knowledge sharing will be studied from both individual and group level. At the individual level, we focus on the effect between inter-period knowledge sharing behaviors, namely, the effect of individual knowledge sharing experience on the emerging of knowledge sharing behavior and mediating effect of individual learning on inter-period knowledge sharing behavior. At the group level, we focus on team knowledge sharing behavior, and cross-level effect of team cohesion and group task conflict on individual knowledge sharing behavior. In addition, we will examine the cross-level and interactive effect of individual level and group level.

This research makes the contributions to the research of knowledge sharing in the following aspects. First, based on individual learning effect, this study researches the influence process and degree of previous individual knowledge sharing behavior to current individual knowledge sharing behavior, and reveals the importance of knowledge sharing experience in the influence factors of individual knowledge sharing behavior. Second, we take knowledge sharing behavior of group level into consideration and examine the effect of previous team knowledge sharing behavior on current individual knowledge sharing behavior. Finally, based on Interactional psychology (Schneider, 1983; Tett & Burnett, 2003; Tett & Guterman, 2000) and theory of situational strength (Mischel, 1968, 1977), we integrates the variable of individual and group level through the interaction of hierarchical variables to investigate group differences of the effect of previous individual learning effect on current knowledge sharing behavior. As far as we know, it is very rare to apply the hierarchical longitudinal research methods in the study of knowledge sharing behavior. We tested the model with using Hierarchical Linear Modeling(Bryk & Raudenbush, 1992) and longitudinal data. This study also answered the researches' call (e.g. G. W. Bock et al., 2005; Jiacheng et al., 2009; S.-C. Yang & Farn, 2009) for using longitudinal data to research knowledge sharing behavior.

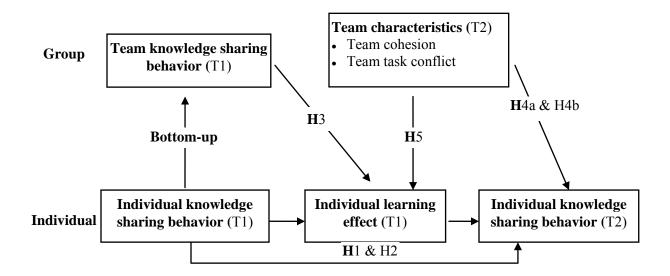## THE THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

Individual Knowledge Sharing Behavior: The Concept and the Understanding in Cross-Level

Knowledge sharing refers to the provision of task information and know-how to help others to solve problems, develop new ideas, and implement policies or procedures (Cummings, 2004; Hansen, 1999; Wang & Noe, 2010). It is an interactive process between team members in the workplace (Srivastava, Bartol, & Locke, 2006). Other studies have shown that the social exchange theory and the theory of social dilemma may help us to understand under what circumstances knowledge sharing is most likely to occur (Wang & Noe, 2010).

Suppose that team knowledge sharing is considered as a generalized social exchange process. Social exchange process depends on the foundation of trust. As a result, trust will play an important role in the process. That is, high trust is beneficial to the occurrence of knowledge sharing, and vice versa. Existing researches also supported this view. For example, source trustworthiness helps enhance knowledge transfer across units (Szulanski, Cappetta, & Jensen, 2004), perception of trust also affects knowledge sharing (Jones & George, 1998). At the same time, individual knowledge sharing behavior is a decision-making process to decide whether to share the knowledge or not by considering its costs and benefits. Only when predicted earnings are more than predicted cost can knowledge sharing happen (Constant, Kiesler, & Sproull, 1994). Individual knowledge sharing makes more organizational members to master knowledge. To gain organizational innovation and development it is necessary for organization to transfer knowledge. In this case, it is very likely to appear "free-rider" phenomenon. That is, the individual shares

benefits from others' thoughts and knowledge with no payment. The phenomenon makes the members who shared knowledge can't get relevant repayment. Accordingly, rational individuals will chose not to share knowledge. Consequently, individual-rationality will expand to collective-irrationality, this could ultimately lead the process of knowledge sharing to trap to social dilemma (Wang & Noe, 2010) which affects the members' will to sharing knowledge. Above knowable, the risk perception exists in the decision-making process of knowledge sharing would clearly affect the occurrence of knowledge sharing behavior.

FIGURE 1
A MULTILEVEL MODEL OF TEAM KNOWLEDGE SHARING BEHAVIOR

Therefore, the increasing trust and perceived risk reduction can promote knowledge sharing behavior in group interaction. At the individual level, individual positive experience on knowledge sharing may improve the mutual trust between team members and reduce the perceived risk, and that ultimately promote individual knowledge sharing. In addition, according to situational strength theory (Mischel, 1968, 1973), there is consistency of individual behaviors in different situation. At the same time, the situation can lead to the similarity in behaviors of different individuals. Under the condition of high situational strength, individual differences are small, while in the case of low situational strength, individual differences are great. And from the perspective of team characteristics, team cohesion and task conflict have influence on team trust and risk perception. Above all, we propose the research model shown in Fig. 1.

The Individual Level of Knowledge Sharing

The core of social exchange theory is "reciprocity". Its reward and cost can be material wealth, psychological wealth and social wealth. The theory insists that social exchange produced social rewards, such as respect, admiration and status. The sharer can gain recognition and respect through showing the expertise. The underlying reason is that people were eager to be regarded as experts and partners. This will let them want to share the knowledge (O'Dell & Grayson, 1998). As the typical form of social exchange, reciprocity makes the individual produce the feeling of responsibility, gratitude and trust. The purpose of the individual to choose sharing knowledge is to gain future reciprocity and the recognition of others. Expected reciprocity has a significant effect on the individual attitude toward knowledge sharing.

People generally believe that knowledge sharing is an effective way to form, maintain and strengthen the relationships, and hope to gain the benefits from the relationships (G.-W. Bock, R. W. Zmud, Y.-G. Kim, & J.-N. Lee, 2005).

The positive experiences of individual knowledge sharing in the past make the members produce more trust to knowledge sharing and build trust between the team members, which lead the members to produce more expectation to future reciprocity. It is the expectation to material, psychological and social rewards in the future that makes the members' attitude toward the next knowledge sharing more positive. In addition, the positive experiences can also help the sharer and other members increase the familiarity of the process of knowledge sharing, and reduce the risk perception because of the lack of experience and insufficient information. The reduction of risk perception will be beneficial to promote more knowledge sharing behavior. In conclusion, we suggest that:

> *Hypothesis 1: the current individual knowledge sharing behavior is positively related to the next individual knowledge sharing behavior.*

Building on hypothesis 1 as well as the above arguments and research evidence, the reason why people share knowledge is social exchange, and the core of social exchange is "reciprocity" (G.-W. Bock et al., 2005). If knowledge sharing between the team members is regarded as a social exchange in a broad sense, then the benefits that the member gain from the knowledge sharing mainly show by others' knowledge and information. Those knowledge and information are benefit to improving learning effect. So, individual learning effect plays an important role between the previous knowledge sharing behavior and current knowledge sharing behavior. Specifically, individual knowledge sharing behavior brings the improvement of learning effects. This improvement makes the individual perception to benefits more obviously. Meanwhile, it can also help to reduce the risk perception on the knowledge sharing of next phase, then make the significant and positive impact on the attitude toward the next knowledge sharing. So, we suggest that:

> *Hypothesis 2: individual learning effect is a mediator between the previous knowledge sharing behavior and current knowledge sharing behavior.*

The Group Level of Knowledge Sharing Behavior

Situational strength theory (Mischel, 1968, 1973, 1977) argues that individual behavior is interactive action of the individual and situation. Situational cues are clearer under the condition of high situational strength, which make the expectations of the situation convey to the individual more powerful, and thus limit the expression of individual characteristics. Individual behaviors are more affected by the situation, and individual differences are smaller. On the contrary, situational cues are vague in the case of low situational strength so that the limitation of the expression of individual characteristics is weaker. Thus Individual differences are bigger.

In view of the above, team knowledge sharing, team cohesion and team task conflict are all important team situational variables to individual knowledge sharing. With low situational strength, there is no close relationship between team situational variables and individual knowledge sharing behavior. While in the case of the high situational strength, the relationship is closer.

Team Knowledge Sharing Behavior

In the team that knowledge sharing activities are frequently, team members can have more opportunities to gain other members' exclusive knowledge and information. These knowledge and information can improve the individual learning effect. In addition, if the atmosphere of knowledge sharing in the team is stronger, the member affected by the atmosphere may be more active and willing to accept the knowledge and information which other members shared. Therefore, we argue that in the team that knowledge sharing activities are more frequently, the member's learning effect is higher, and vice versa. So, we suggest that:

Hypothesis 3: after controlling the influences on individual knowledge sharing of individual level, knowledge sharing of group level is positively related to individual learning effect.

Team Cohesion

Team cohesion is the attraction between the team members and the strength of the willingness to stay in a organization (Keyton & Springston, 1990). In the team of high cohesion, members have more intense to cooperate and interact. George and Bettenhause (1990) have revealed that team cohesion would have a positively prediction effect on the prosocial behavior. A meta-analysis also shows that the high correlation between cohesion and behavior performance (Beal, Cohen, Burke, & McLendon, 2003). Based on the above analysis, we assume that high team cohesion is positively related to individual knowledge sharing behavior. So, we suggest that:

> *Hypothesis 4a: after controlling the inter-period influences on individual learning effect of individual level, team cohesion of group level is positively related to individual knowledge sharing behavior.*

Team Task Conflict

Team task conflict is referred as the disagreement among the member on the task process, because of the difference of the members' cognitive on the process and the way to achieve the task's purpose. (K.A. Jehn, Northcraft, & Neale, 1999). On the one hand, when the conflict exists, the member lacks the will to share knowledge with others and tends to think that other members want to influence him by sharing knowledge. This will lead to distrust on the shared knowledge. On the other hand, the existence of the conflict will lead the member to doubt about other members' motivations to put forward different ideas, even think normal interaction as a personal attack (Karen A Jehn, 1997). (R. A. Baron, 1984) also pointed out that the exchange of the divided opinions would often become the transmission of the negative emotion in the early stage of the conflict, thus causing members to waste too much time and energy on it and eventually leading to the reduced level of knowledge sharing related to the task. So, we suggest that:

> *Hypothesis 4b: after controlling the inter-period influences on individual learning effect of individual level, team task conflict of group level is negatively related to individual knowledge sharing behavior.*

The Multi-Level Interactions of the Situation

The past experience on knowledge sharing behavior has different influences in different situation(Wang & Noe, 2010). As situational strength theory (Mischel, 1968, 1977) said, under the condition of high situational strength, individual behavior will be more affected by the situation. And members' behaviors have higher consistency. On the contrary situation, individual behaviors will have more individual differences because of the lack of corresponding norms or rules. In the team with obvious team character (such as high team cohesion), team knowledge sharing behavior is less affected by individual experience, inter-individual differences on knowledge sharing behavior will be smaller. In the other team with weak team characters (such as low team cohesion), team knowledge sharing behavior is less affected by the situation, but more affected by individual experience. That is, situational factors moderates the relationship between individual learning effect and inter-period individual knowledge sharing behavior. So, we suggest that:

> *Hypothesis 5: team character of group level moderates the relationship between individual learning effect and inter-period individual knowledge sharing behavior such that the relationship is weaker when the team characters are more obvious, and vice versa.*

METHODS

Sample and Procedure

Participants were chosen from a comprehensive university with high popularity. They were all undergraduates who participated in human resource management and operation management courses. 535 students had participated in our survey for one semester (16weeks). Of these students, 246 were male, accounting for 46% of the sample.

The research is conducted as follows: over a 3-week period at the beginning of new semester, we administered questionnaires of personal qualities to the students who volunteered to participate. Then they were randomly divided into groups. Finally, we have 67 groups and the group scale ranged from 5 to 9. In the middle of the semester, the students were given group assignment to complete in groups. The assignment was related to the courses they studied. After the assignment was completed, the students also completed a survey with questions about the relevant variables.

The survey during the research process was implemented by online-questionnaires. So we also objective recorded of the time that the students used in the process of questionnaire completion to help us judge the validity of the questionnaire. If the time was less than 2 minutes or the completion was less than 90 percent of the questionnaire, that questionnaire was judged as invalid. Finally, we obtained 481 valid questionnaires. The valid rate was 90%.

Measures

Knowledge sharing behavior: using the 5-item measure from Chen et al (2009). A 5-point Likert-type scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), was applied to the measure. The items are "I often spend a lot of time sharing knowledge with team members" "I often actively share my knowledge with team members", "I often take part in discussing several aspects of the task, rather than a particular aspect", "I often respond to comments that others make to my advices", "I often participate in knowledge sharing activities in group". The Cronbach's alpha for the scale was .84.

Learning effect: because of no ready-made measure, we independently developed a 4-item measure according to the definition of learning effect and the situation. A 5-point Likert-type scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), was applied to the measure. The items are "learn a lot of new knowledge", "get lots of new inspiration", "learn the new method to solve the problem", "learn the new way to thinking". The Cronbach's alpha for the scale was .84.

Group-level antecedents: the group-level antecedents are formed by individual-level antecedents. We examined the validity of the group-level constructs using R_{wg} (James, Demaree, & Wolf, 1984, 1993), intraclass correlation (ICC[1]) and reliability of the mean (ICC[2]). The indexes of all variables met the requirement well. Specific indexes are presented in table 1.

Team cohesion: using the 6-item measure by adapting the measures from Faraj & Yan (2009) and Tekleab et al (2009) into group-level. A 5-point Likert-type scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), was applied to the measure. The items are "our team members try the best to achieve its performance targets together", "all our team members are responsible for any loss or low performance", "our team members can communicate freely and complete our respective responsibilities to this project", "Our team members can help each other when we do the group projects", "our team members get along well", "our team members work closely together". The Cronbach's alpha for the scale was .91.

Task conflict: using the 3-item measure from Jehn et al (1999). A 5-point Likert-type scale, ranging from 1 ("never") to 5 ("very infrequently"), was applied to the measure. The items are "number of times that the member don't agree to what every member should do", "number of times that the member don't agree to the way to complete group tasks", "number of times that the appearance of the conflict on the task assignment in group". The Cronbach's alpha for the scale was .87.

Data Analysis

First, we tested the reliability and validity of the scale of variables. The variables of group level were combined by variables of individual level, so we tested the validity the construct of group-level variables by testing variables' intraclass consistency R_{wg} (James et al., 1984, 1993), intraclass correlation (ICC[1]) and reliability of the mean (ICC[2]).

The model of knowledge sharing behavior in this study was cross-level. The dependent variable, knowledge sharing behavior and the mediator, learning effect are the variable of individual level and the independent variables includes variables of individual level and group-level. So, we use Hierarchical Linear Model (HLM) (Bryk & Raudenbush, 1992) to test the model in the following steps. First, we estimated the following models according to the steps related to testing mediator(R. M. Baron & Kenny, 1986): (1) the dependent variable, individual learning effect (T1) was predicted by individual knowledge sharing behavior (T1) in the model; (2) the dependent variable, individual knowledge sharing behavior (T2) was predicted by individual knowledge sharing behavior (T1) in the model; (3) the dependent variable, individual knowledge sharing behavior (T2) was predicted by individual learning effect (T1) in the model; (4) the dependent variable, individual knowledge sharing behavior (T2) was predicted by individual knowledge sharing behavior (T1) and individual learning effect (T1) in the model. In addition, we estimated the model, which included the dependent variable, individual learning effect (T1) and the independent variables, individual knowledge sharing behavior (T1) of individual level and team knowledge sharing behavior (T1) of group level. In order to test cross-level and direct effect of team characters, we analyzed in the following three steps: (1) we estimated a null model to analyze the makeup of intraclass and interclass variance of individual knowledge sharing behavior. The null included the independent variable, individual knowledge sharing behavior (T2) but no other independent variables of individual and group level. (2) individual-level analysis: adding individual learning effect to test the effect on knowledge sharing behavior. (3) group-level analysis: adding team cohesion and team task conflict to test cross-level and direct effect on knowledge sharing behavior. Finally, we analyzed the interaction by estimating the slope of group-level variables to individual-level variables. All model estimations have controlled the influence of individual gender and GPA.

RESULTS

The Validity of Measures
The Validity of Knowledge Sharing Behavior

Due to knowledge sharing behavior is the main dependent variable and we applied self-report to measure, we analysis in the following steps to verify the validity of the construct of knowledge sharing behavior. First, we tested the dimension of knowledge sharing behavior by factor analysis. The results showed that the items all belong to a factor, and have high factor loadings (the load average is 0.78), the factors' cumulative explained 61% of variance. Then, we tested the criterion-related validity of knowledge sharing behavior by testing the relationship between knowledge sharing behavior and other variables which are related to knowledge sharing in theory. In the table 1 we can see the correlation results are consistent with the theoretical model proposed. At the individual level, knowledge sharing behavior (T1) and knowledge sharing behavior (T2) are significant related to learning effect (T1) ($r = .37, p < .01 ; r = .38, p < .01$). At the group level, team knowledge sharing behavior (T1) is significant related to team cohesion (T2) ($r = .71, p < .01$) and team task conflict ($r = -.38, p < .01$). These results indicate that knowledge sharing behavior has a good criterion-related validity.

In addition, we tested the discriminate validity of knowledge sharing behavior by testing the relationship between knowledge sharing behavior and other uncorrelated variables to knowledge sharing in theory. There is no theoretical and empirical evidence can test the significant correlation of knowledge sharing behavior to individual gender and GPA. The data results show that there is no significant relationship between knowledge sharing behavior (T1) and gender ($r = .09, p > .1$) or GPA ($r = .05, p > .1$), and also between knowledge sharing behavior (T2) and gender ($r = -.01, p > .1$) or GPA ($r = .03, p > .1$).

So, this measure has acceptable discrimination validity.

In a word, the above results show that the knowledge sharing behavior is the structure of a single factor. And it is significantly related to the relevant variables in theory, while there is no significant relationship with the unrelated variables which comes from the same source. So, the measurement of the scale is effective.

TABLE 1
CORRELATIONS, CREDIBILITY, MEANS, STANDARD DEVIATIONS[a]

Variables	Mean	SD	1	2	3	4
Level 1						
1. Individual knowledge sharing behavior (T1)	3.73	0.58	(0.84)			
2. Individual knowledge sharing behavior (T2)	3.73	0.58	0.62**	(0.87)		
3. Learning effect (T1)	3.84	0.71	0.37**	0.38**	(0.90)	
4. Gender[b]	0.54	0.50	0.09	-0.01	-0.01	
5. GPA	3.21	0.59	0.05	0.03	0.07	0.29**
Level 2						
1. team knowledge sharing behavior (T1)	3.72	0.31	(0.84)			
2. team cohesion (T2)	3.96	0.32	0.71**	(0.91)		
3. team task conflict (T2)	2.33	0.36	-0.38**	-0.45**	(0.87)	

[a]n＝481 at the individual level, n=67 at the group level. Internal consistency reliabilities of variables are provided in diagonal parentheses.
[b]Intraclass R^2 is calculated based on the proportion of variance in team which can be explained by the variables of level 1.
† P<0.10, * P<0.05, ** P<0.01

The Combination of Variables of Group Level

We tested the feasibility of group-level variables (team knowledge sharing behavior, team identification, innovation atmosphere, relationship conflict and task conflict) on the merging of individual data. So, we calculated variables' R_{wg}, ICC [1] and the ICC [2] to test intraclass consistency and hierarchical characteristics. R_{wg} is calculated by reference uniform distribution (James et al., 1984, 1993), the calculation of ICC [1] applied the formula ($ICC[1] = \tau_{00} / (\tau_{00} + \sigma^2)$) which was suggested by Hofmann, ICC[2] was calculated with using the formula ($ICC[2] = \frac{k * ICC(1)}{1 + (k - 1) * ICC(1)}$)(Bliese, 2000).

The results are shown in table 2. And we can see the data is suitable for merge operations.

TABLE 2
VARIABLES' R_{wg} AND ICC

Variables	Rwg	ICC[1]	ICC[2]
Team knowledge sharing behavior (T1)	0.94	0.11	0.90
Team cohesion (T2)	0.94	0.13	0.91
Team task conflict (T2)	0.87	0.04	0.74

The HLM Results: The Cross-Level Effect of Individual Knowledge Sharing and Mediating Effect of Learning Effect

The Inter-Period Effect of Individual Knowledge Sharing Behavior

We purposed that individual knowledge sharing behavior had positive influence on inter-period knowledge sharing behavior. The hypothesis 1 gets support, which means that regression coefficients of individual knowledge sharing behavior (T1) to individual knowledge sharing behavior (T2) must be significant. So, we estimated the model which included control variables and individual knowledge sharing behavior (T1) model with HLM. The result shows that the regression coefficient is significant (β.64, p.01) in model 3 of table 3. So, hypothesis 1 gets the support.

TABLE 3
HLM RESULTS OF INTER-PERIOD PROCESS OF INDIVIDUAL
KNOWLEDGE SHARING BEHAVIOR [a]

Variables	Individual learning effect (T1)		Individual knowledge sharing behavior (T2)		
	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effect					
Level 1					
Intercept	1.96**	0.20	1.28**	2.48**	1.01**
	(0.07)	(0.27*)	(0.37)	(0.16)	(0.46*)
Individual knowledge sharing behavior (T1)	0.45**	0.25**	0.64**		0.57**
	(0.00)	(0.02)	(0.03)		(0.02*)
Individual learning effect (T1)				0.32**	0.14**
				(0.01)	(0.01**)
Gender	-0.10	-0.10	-0.07	-0.02	-0.06
GPA	0.08	0.08	0.03	0.01	0.03
Level 2					
Team knowledge sharing behavior (T1)		1.34*			
Variance analysis					
Intraclass variance	0.43	0.43	0.19	0.27	0.18
Deviance	776.15	774.56	385.25	489.06	376.21

[a]n＝481 at the individual level, n=67 at the group level (because the missing items are deleted in model 1and model 2, n=49), random variance is provided in parentheses.
[b]Intraclass R^2 is calculated based on the proportion of variance in team which can be explained by the variables of level 1.
[†] P<0.10, [*] P<0.05, [**] P<0.01

The Mediating Effect of Learning Effect

We estimated the following three models according to the steps related to testing mediator (R. M. Baron & Kenny, 1986): (1) the dependent variable, individual learning effect (T1) was predicted by individual knowledge sharing behavior (T1) in the model; (2) the dependent variable, individual knowledge sharing behavior (T2) was predicted by individual learning effect (T1) in the model; (3) the dependent variable, individual knowledge sharing behavior (T2) was predicted by individual knowledge sharing behavior (T1) and individual learning effect (T1) in the model. Results are shown as model 1, model 4 and 5 of table 3. We can see the regression coefficient of individual knowledge sharing behavior

(T1) is significant to individual learning effect (T1) (β.45, p.01). The regression coefficient of individual learning effect (T1) is significant to individual knowledge sharing behavior (T2) (β.32, p.01). And in the model 3, the coefficients of individual knowledge sharing behavior (T1) and individual learning effect (T1) are still significant (β.57, p.01 , β.14, p.01), but the coefficient of individual knowledge sharing behavior (T1) drops. So, individual learning effect has partial mediating effect, hypothesis 2 gets partial support.

The HLM Results of the Cross-Level Effect of Team Knowledge Sharing and Team Characters
The Cross-Level Direct Effect of Team Knowledge Sharing Behavior
We applied HLM to analysis because of the involved individual and group level. At the individual level, we controlled the influence of individual gender and GPA. At the group level we included team knowledge sharing behavior. Results showed that there is significant positive correlation between team knowledge sharing behavior and individual learning effect ($\hat{r} = .25, p < .01$). So, hypothesis 3 gets support.

The Cross-Level and Direct Effect of Team Characters
The hypothesis 4a and 4b get the support, which means that the inter-team variance of knowledge sharing must be significant. To test hypothesis 4a and 4b, we estimated the three HLM model. First, we estimated the null model which only consists of the control variables of individual level with no variables of individual and group levels. The results are shown in the null model of table 4. The variance of the intercept of group level is significant ($\hat{\tau}_{00} = .02, p < .05$). The ICC [1] of individual knowledge sharing behavior (T1) is .11, indicating 11% of the variance of knowledge sharing behavior between groups, 89% of the variance is within the group.

TABLE 4
THE RESULTS OF CROSS-LEVEL EFFECT ON KNOWLEDGE SHARING BEHAVIOR [a]

Variables	Individual knowledge sharing behavior (T2)		
	Null model	Model 1	Model 2
Fixed effect			
Level 1			
Intercept	3.67**(0.02*)	2.48** (0.16)	0.38(0.29*)
Individual learning effect (T1)		0.32** (0.01)	0.25** (0.02)
Gender	-0.03	-0.02	-0.02
GPA	0.03	0.01	0.03
Level 2			
Team cohesion (T2)			0.55**
Team task conflict (T2)			0.06
Variance analysis			
Intraclass variance	0.32	0.27	0.25
Intraclass R2 b		0.16	0.07
Inter-class R2		-	-
Deviance	636.09	489.06	465.41

[a]n＝481 at the individual level, n=67 at the group level (because the missing items are deleted in model 1and model 2, n=49), random variance is provided in parentheses.
[b]Intraclass R^2 is calculated based on the proportion of variance in team which can be explained by the variables of level 1.
[†] P<0.10, [*] P<0.05, [**] P<0.01

Model 1 included individual learning effect (T1) of individual level. Model 2 added team cohesion (T2) and team task conflict (T2) on the basis of model 1. Results showed that there was a significant and positive correlation between team cohesion ($\hat{r} = .55, p < .01$) and knowledge sharing behavior after controlling the influence of individual level. So, hypothesis 4a is supported, while hypothesis 4b is not supported.

The Test of Cross-Level Moderating Effect of Team Characters

Hypothesis 5 proposed the cross-level moderating effect. The premise behind the test of the effect is individual learning effect have significant random variance in the model whose result is the intercept. As we can see from the random variance which is provided in parentheses of model 2 in table 4, individual learning effect did not have significant random variance. Above all, hypothesis 5 did not get the support.

DISCUSSIONS

Existing researches on knowledge sharing behavior are divided and focused on the individual or group level, but this study considered two perspectives of macro and micro, combined with the effect of these two levels. We proposed and tested a hierarchical model of knowledge sharing behavior, and verified the effect of variables of individual level (inter-period individual knowledge sharing behavior, individual learning effect) and group level (team knowledge sharing behaviors and characteristics), and multi-level moderating effect. Our study found that there are individual and group differences among knowledge sharing behaviors, inter-period individual knowledge sharing behavior and team characters of group level—team cohesion can explain most of the variance.

Individual knowledge sharing behavior which had been combined to group level can explain the majority of the variance of individual learning effect through a bottom-up process. At the same time, there is a positive relationship between the individual knowledge sharing behavior and learning effect. In addition, we used HLM to analysis in cross-level. Thus we can test multi-level moderating effect of team characters on knowledge sharing behavior while testing the effect of individual learning effect on knowledge sharing behavior. This study answers the calls of researchers(Wang & Noe, 2010) as mentioned above it is also benefit to do deeper into the research about the affecting factors of knowledge sharing behavior.

This study triggered our further thinking on the knowledge sharing behavior. Future research may need to make some necessary changes of the model or variable measurement. For example, there was no significant correlation between task conflict and knowledge sharing behavior. Based on the situational strength theory, the cross-level interaction of individual and group level should have a moderating effect on knowledge sharing behavior. However, the hypothesis in the study did not get support. It means that no matter how to change team characters, the effect of individual learning effect on knowledge sharing behavior is not change. One possible explanation is that this cross-level moderating effect may also be affected by knowledge complementary difference of members. Stronger the knowledge complimentary is, more obvious the moderating effect is, and weaker the knowledge complimentary is, weaker the moderating effect is. In other words, in this interactive moderating effect is a three-way interaction. We can add knowledge complementary to further test the existence of the three-way interaction adjustment in the future.

STUDY LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study has at least several limitations that may be addressed by future research directions. First, as the mainly dependent variable in the study, the knowledge sharing behavior was measured by means of self-report, this may bring the problem of common method variance. We have verified that there was no problem of common method variance in the data of this study. However, future research still need to try to

further strengthen the research of reliability and persuasive through a variety of data sources (e.g., add the measuring way of others' evaluation).

Second, although we proposed the key factors that may have influence on knowledge sharing behavior of different levels, we did not take some other important and deserved variables into consideration (e.g., individual experience and attitude of knowledge sharing, structural factors of team characters: knowledge complementarity of team members, the heterogeneity of education levels and values, etc).

Third, the limitation is a common problem in the findings of the studies. Participants for this study are university students. Even though the knowledge sharing behavior of students in the university do not have a fundamental difference with the knowledge sharing behavior of the members in other organizations, future studies need to promote the finding to be generalizable.

MANAGERIAL IMPLICATIONS

To a large extent, the success of organizational knowledge management lies on the degree of team knowledge sharing activity, so organizations must consider how to transfer expertise and knowledge from experts who have it to novices who need to know (Hinds, Patterson, & Pfeffer, 2001). However, the process of knowledge sharing does not happen naturally, there are a lot of factors that affect team knowledge sharing. To help managers to better trigger team knowledge sharing we should understand these factors and how these factors interactive affect.

The results of this study show that the degree of the members' knowledge sharing with others is affected by individual experience of knowledge sharing, and individual learning effect is the mediator in the effect. So in the process of knowledge management, managers should pay the attention to members' knowledge sharing behavior and willingness in the early stage of team knowledge sharing. And strengthen the management of individual learning effect. Factors which affect individual learning effect are various (e.g., others' support and help, organizational training, individual knowledge structure and learning ability). In addition, team cohesion can also promote team members for knowledge sharing, so managers can improve team cohesion through a variety of ways to promote the interaction and cooperation between team members. That is conducive to team knowledge sharing.

The study takes the variable of individual level and group level into account at the same time, puts forward a hierarchical and theoretical framework of knowledge sharing behavior, and tests the cross-level effect through the cross-level and longitudinal data. In conclusion, this study makes great contribution to the research on knowledge sharing behavior and learning effect.

ENDNOTES

REFERENCES

Alavi, Maryam, & Leidner, Dorothy E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly, 25*(1), 107-136.

Baron, Reuben M, & Kenny, David A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(6), 1173.

Baron, Robert A. (1984). Reducing organizational conflict: An incompatible response approach. *Journal of Applied Psychology, 69*(2), 272.

Beal, D.J., Cohen, R.R., Burke, M.J., & McLendon, C.L. (2003). Cohesion and performance in groups: A meta-analytic clarification of construct relations. *Journal of Applied Psychology, 88*(6), 989.

Bliese, P. D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analyses. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 349 - 381). San Francisco: Jossey-Bass.

Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, J. N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *Mis Quarterly*, 87-111.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models*. Newbury Park, CA: Sage.

Chen, Irene YL, & Chen, Nian-Shing. (2009). Examining the Factors Influencing Participants' Knowledge Sharing Behavior in Virtual Learning Communities. *Journal of Educational Technology & Society, 12*(1).

Constant, David, Kiesler, Sara, & Sproull, Lee. (1994). What's mine is ours, or is it? A study of attitudes about information sharing. *Information systems research, 5*(4), 400-421.

Cummings, J. N. (2004). Work groups, structural diversity, and knowledge sharing in a global organization. *Management science*, 352-364.

Faraj, Samer, & Yan, Aimin. (2009). Boundary work in knowledge teams. *Journal of Applied Psychology, 94*(3), 604.

George, Jennifer M, & Bettenhausen, Kenneth. (1990). Understanding prosocial behavior, sales performance, and turnover: a group-level analysis in a service context. *Journal of applied Psychology, 75*(6), 698.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative science quarterly, 44*(1), 82-111.

He, W., & Wei, K. K. (2009). What drives continued knowledge sharing? An investigation of knowledge-contribution and-seeking beliefs. *Decision Support Systems, 46*(4), 826-838.

Hinds, P.J., Patterson, M., & Pfeffer, J. (2001). Bothered by abstraction: The effect of expertise on knowledge transfer and subsequent novice performance. *Journal of Applied Psychology, 86*(6), 1232.

Hsu, Meng-Hsiang, Ju, Teresa L., Yen, Chia-Hui, & Chang, Chun-Ming. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International Journal of Human -- Computer Studies, 65*(2), 153-169.

James, Lawrence R., Demaree, Robert G., & Wolf, Gerrit. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology, 69*(1), 85-98.

James, Lawrence R., Demaree, Robert G., & Wolf, Gerrit. (1993). rwg: An Assessment of Within-Group Interrater Agreement. *Journal of Applied Psychology, 78*(2), 306-309.

Jehn, K.A., Northcraft, G.B., & Neale, M.A. (1999). Why differences make a difference: A field study of diversity, conflict and performance in workgroups. *Administrative science quarterly, 44*(4), 741-763.

Jehn, Karen A. (1997). A qualitative analysis of conflict types and dimensions in organizational groups. *Administrative science quarterly*, 530-557.

Jiacheng, Wei, Lu, Liu, & Francesco, Calabrese A. (2009). A cognitive model of intra-organizational knowledge-sharing motivations in the view of cross-culture. *International Journal of Information Management, In Press, Corrected Proof*.

Jones, G.R., & George, J.M. (1998). The experience and evolution of trust: Implications for cooperation and teamwork. *Academy of Management Review*, 531-546.

Keyton, J., & Springston, J. (1990). Redefining cohesiveness in groups. *Small Group Research, 21*(2), 234-254.

Mischel, W. (1968). *Personality and assessment*. New York: Wiley.

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. *Psychological review, 80*(4), 252.

Mischel, W. (1977). The interaction of person and situation. *Personality at the crossroads: Current issues in interactional psychology, 333*, 352.

Nonaka, Ikujiro, Byosiere, Philippe, Borucki, Chester C., & Konno, Noboru. (1994). Organizational knowledge creation theory: A first comprehensive test. *International Business Review, 3*(4), 337-351.

O'Dell, Carla, & Grayson, C Jackson. (1998). If only we knew what we know: Identification and transfer of internal best practices. *California management review, 40*(3), 154-174.

Schneider, B. (1983). Interactional psychology and organizational behavior. *Research in organizational behavior*.

Srivastava, A., Bartol, K. M., & Locke, E. A. (2006). Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *The Academy of Management Journal, 49*(6), 1239-1251.

Szulanski, G., Cappetta, R., & Jensen, R.J. (2004). When and how trustworthiness matters: Knowledge transfer and the moderating effect of causal ambiguity. *Organization Science, 15*(5), 600-613.

Tekleab, Amanuel G, Quigley, Narda R, & Tesluk, Paul E. (2009). A longitudinal study of team conflict, conflict management, cohesion, and team effectiveness. *Group & Organization Management, 34*(2), 170-205.

Tett, R. P., & Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *Journal of Applied Psychology, 88*(3), 500.

Tett, R. P., & Guterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: Testing a principle of trait activation. *Journal of Research in Personality, 34*(4), 397-423.

Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review, 20*(2), 115-131.

Yang, Heng-Li, & Wu, Ted C. T. (2008). Knowledge sharing in an organization. *Technological Forecasting and Social Change, 75*(8), 1128-1156.

Yang, Shu-Chen, & Farn, Cheng-Kiang. (2009). Social capital, behavioural control, and tacit knowledge sharing--A multi-informant design. *International Journal of Information Management, 29*(3), 210-218.