

# Control Information Quality to Promote Collaborative Learning: A Perspective of Caring Ethical Climate

*Completed Research Paper*

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## Abstract

*Given emergence of advanced computer-mediated technologies and changed manners of teamwork, collaborative learning becomes a popular distributed teamwork mode. Many management control methods, such as information quality control, are utilized to enhance the levels of team collaborative learning, however, the consequences do not always meet managers' expectation, and that is seemingly difficult to be explained by traditional theoretical perspectives. We filled the gap by explaining the mechanism that information quality control can affect levels of collaborative learning via caring ethical climate based on Ethical Climate Theory. By conducting an experiment of collaborative learning lasting 8 weeks, we collected 154 valid samples to analyze. The results verified the complete mediating effect of caring ethical climate. Implications for theory and practice, and limitations are also given.*

**Keywords:** Caring ethical climate, information quality, collaborative learning, management control systems, ethical climate theory

## Introduction

At the era of volatility, uncertainty, complexity and ambiguity stood by UVCA, researchers pay more attention to the teams with stronger collaborative learning ability. In various working scenarios, collaboration teams can solve massive complex problems and provide richer outcomes, which individual work method could be difficult to support (Leinonen and Järvelä 2010). Nowadays, with the advance of computer-mediated technologies and increase in demands of efficient work, distributed team has become a common way of work (Serçe et al. 2011). In the overall processes of team collaboration, high-quality collaborative learning is one of the most focused objectives by online education, large-scale software development, crowdsourcing, and many other business situations (Zhang et al. 2017; Alavi 1994). In these contexts, people from different spaces and time zones need to make social

connections, learn actively, collaborate together, and create new knowledge to achieve team goals, and these processes all belong to collaborative learning (Leinonen and Järvelä 2010). Hence, promoting the level of collaborative learning has become a crucial focus of distributed team management.

One important perspective of enhancing levels of collaborative learning is optimizing design of computer-mediate technologies, which could provide tools supports for collaborative learning in teams (So and Brush 2008; Serçe et al. 2011). With diversification of technologies and manners of working, massive communication tools, like e-mails, collaboration tools, social media or industry specific software could help distributed teamwork more efficient and smooth going. However, some distributed teams aiming at efficient collaborative learning do not always achieve their goals as planned. One of the key reasons is that there is a lack of effective supervision and positive climate construction. Different from traditional face-to-face teams, though appropriate tools can be provided, distributed teams have the characteristic of geographical separation, which can cause the lack of the opportunities of making interpersonal relationships and communications (Espinosa et al. 2007). Sometimes anonymity behind the Internet could even lead to negative behaviors (Ellison - Potter et al. 2010), such as ‘slack working’ and ‘free riding’ in teamwork. Negative team climate can be caused by these potential adverse impacts of distributed collaboration nature, which further damage outcomes of the whole team, such as collaborative learning. In this case, constructing positive team climate is crucial to the success of collaborative learning. We argue caring ethical climate could be regarded as important. Ethical climate theory was proposed by (Victor and Cullen 1988) and was widely studied and applied in academia and industries. Caring ethical climate, as a positive ethical climate based on benevolence perspective, has been verified to make major effects in work outcomes and firm performance (Victor and Cullen 1988; Ambrose et al. 2008; Domino et al. 2015; Cullen et al. 2003). Therefore, the consequences of caring ethical climate in collaborative learning quality is deserved to be discussed.

Information controls and other management controls are provided by scholars to promote team collaboration outcomes and climates (Goebel and Weißenberger 2017), however, how these management control methods, such as information quality control, affect team collaboration is lack of comprehensive understanding. Especially in contexts of distributed teamwork, how collaborative learning supported by computer-mediate tools can be affected by management control methods has not got verified. In online environment, information quality is a crucial indicator for peoples’ communication and collaboration (Andreas I Nicolaou and McKnight 2006; Andreas I. Nicolaou and Mcknight 2011), and information quality control can be used as a method of management control in distributed environment. For example, claiming that all team members need to share their work progress and personal work state will help to form strong social connections and caring climate for the overall team. Hence, in this paper, we argue information quality control could promote collaborative learning by enhancing caring ethical climate.

Hence, from the perspective of ethical climate theory, we proposed our research questions: In distributed collaboration teams, 1) *whether information quality control can promote collaborative learning?* 2) *Can caring ethical climate mediate the relationship between information quality control and collaborative learning?*

## **Literature review**

### ***Management control systems and information quality control***

Multiple methods in management control context have been used by managers to affect subordinates’ behavioral propensities to promote performance, and management control received scholars’ attention more than two decades ago (Malmi and Brown 2008). Definitions of management control are different in various perspectives (Malmi and Brown 2008). For example, Merchant and Otley (2006) distinguished management control from strategic control and argued that management control makes it possible for employees to do things that organizations want them to do in order to help organizations receive benefits, while Chenhall (2004) gave a broader definition, they held that management control is a broader term of management accounting, which can be used to achieve some goals by different kinds of controls (such as personal and clan controls). However, as management control system itself, the functions and operations are relatively recognized. As such, in management

control systems, all management control methods are adapted to finish organization's objectives and strategies (Kenneth et al. 2011). Management control systems can provide high-quality information continuously for people to do better in work and help maintain effective behavior patterns of organization in workplace (Otley 1999). The important role of the management control is to ensure the environment and social activities consistent with organizational objectives and strategies by evaluating relevant risks, optimizing use and cost of resources, and so on from managerial perspective (Arjaliès and Mundy 2013). Benefits from implement management control systems are also multifaceted, since scholars divided systems into different types from different perspective, such as formal controls and informal controls, behavior controls and outcome controls, mechanistic controls and organic controls (Langfield-Smith and Smith 2003). For example, when teams are undertaken the objectives of high output need and task programmability, outcome controls and behavior controls, as the two important control contents of management control systems, should be utilized to suit the situations (Ouchi 1979).

Traditional perspectives of performance measurement have been transferred to that of performance management since the appearance of management control systems (Otley 1999). An important link in management control systems implementation is that managers and other members in organization or teamwork make good use of information provided by systems (Otley 1999). According to prior researches, many scholars of management control systems concentrated on the information provided by systems, usefulness of information, use degree of information, and beneficial nature of systems (Chenhall 2004; Chenhall and Morris 1986). Information quality became one important control factor that decided whether management control can be implemented successfully. In IT success literature, information quality can be defined as how the degree of information output characteristics could match the receivers' requirements of information (Bailey and Pearson 1983). Applying it in organization or team management context, managers can adjust management control strategies reflected by information quality control, namely, improving information quality to accomplish management objectives and construct beneficial management environment. Information quality can be controlled in different aspects, such as validity, relevance, currency, accuracy, interpretability, and integrity (Andreas I Nicolaou and McKnight 2006). Andreas I. Nicolaou and McKnight (2011) proposed and verified that two interventions of system design, control transparency and outcome feedback can form system users' perceived information quality and further influence their information related judgments. In their theory, control transparency refers to the degree information can be visible to users (Andreas I Nicolaou and McKnight 2006; Finel and Lord 1999), while outcome feedback refers to the availability of users' practical and specific information about business (Andreas I Nicolaou and McKnight 2006). Malmi and Brown (2008) integrated management control systems researches and provided five groups that could be structured: planning, cybernetic, reward and compensation, administrative and cultural controls, and each group also includes some sub-terms. Information quality control concept can be applied into control process of cybernetic, reward and compensation, and administrative, which has potentially important influence in implement of management control strategies.

### ***Ethical climate theory and caring ethical climate***

In research field of workplace or corporate ethics, one of the most influential construct is ethical climate (M. Y. Cheng and Wang 2015; Martin and Cullen 2006). Ethical climate theory provides a framework of the antecedents and consequences of different ethical climates based on moral reasoning and organizational theory (Victor and Cullen 1988). Ethical climate refers to a state of individuals' constructive representations and psychological cognitions of the ethical environment and also can be expressed as a shared perception among all members to organizational or team-level ethical code (Schneider 1975; Anderson and West 1998). During the development of ethical climate theory, Victor and Cullen (1988) divided ethical climate into different dimensions according to the perspectives of moral reasoning, in which, benevolence is a crucial category of moral judgement. They also proposed 'caring ethical climate' as an individual and local aspect of benevolence ethical climate (Victor and Cullen 1988). Benevolence was inclined to chase the maximization of all members' interests and welfare (M. Y. Cheng and Wang 2015). Therefore, in ethical climate of caring dimension, members in teams would follow the manner for promoting well-being of each member in team and even outside team who could be affected by their ethical judgement and decisions (Wimbush and Shepard 1994).

Wimbush and Shepard (1994) firstly enriched ethical climate theory by linking caring ethical climate to behaviors in organizations and proposed that supervision was one of the important factors of ethical climate perception and behavior of subordinates. Martin and Cullen (2006) directly linked ethical climate theory to the consequence of cognitive and affective states by meta-analytic review. Based on benevolence perspective of moral judgement, caring ethical climate has been proved to have positive relationship with organizational or team commitment, which belongs to affective responses to ethical climate (Cullen et al. 2003; Martin and Cullen 2006; Ambrose et al. 2008; Domino et al. 2015). In practical workplace, caring ethical climate has also been proved to have relationships with various individual work outcomes (Martin and Cullen 2006; Simha and Cullen 2012). Further, based on previous researches, Goebel and Weißenberger (2017) held that caring ethical climate could bring benefits to organizational performance. In this study, we focus on the issue of caring ethical climate, namely, its antecedents, consequence, and effects in teamwork collaboration. Therefore, we observed all team members' perception of caring ethical climate during collaboration, and then conducted a quantitative analysis to achieve research objectives.

### ***Collaborative learning in distributed team***

Collaborative learning refers to social processes by which a group people learn together to participate in collaboration and solve some problems, it does not only apply to education context, but workplace collaborative teamwork (Alavi 1994). This concept is obtained by Alavi (1994) after a review of cognitive learning theory and three identified learning processes: active learning and construction of knowledge, cooperation and teamwork in learning, and learning via problems solving. Whipple (1987) pointed out collaborative learning lead to the emergence of new knowledge and interactive understanding with the member who contributes to the learning process. With the computer-based technology generation changes, collaborative teamwork has been proved to be an effective method to solve complex problems and create new knowledge (Leinonen and Järvelä 2010). Meanwhile, collaborative learning is proved to be an important performance of collaborative teamwork (Leinonen and Järvelä 2010; Schwartz 1995).

Advances in technology and change of needs in workplaces require people qualified to work in distributed environment (Serçe et al. 2011). Distributed teams have different characteristics from traditional face-to-face teams. On one hand, distributed teams often consist of members who are geographically segregated and even culturally different, and the lack of face-to-face communication asks for some high demands for effective team collaboration (Jarvenpaa et al. 1998). For example, distributed teams need the support of specialized collaborative technologies to achieve team success (X. Cheng et al. 2017; Lowry and Jr 2005). In this context, collaborative learning is crucial to enhance work efficiency, communication, problem solving capability and interpersonal relationship in a team, and becomes a crucial performance of teamwork collaboration (Zhang et al. 2017).

People's perceived levels of collaborative learning include integration of engagement, effectiveness, efficiency and satisfaction (So and Brush 2008). In previous researches, the mechanism of enhancing collaborative learning levels in distributed team was discussed in different perspectives, such as management controls, members' interpersonal relationships, and social environment. There are two main perspectives of these researches. One is to enhance computer-mediated communication of collaborative learning by promoting tools designed to achieve information synchronization; the other is to utilize social constructivism to establish appropriate climate for collaborative learning (So and Brush 2008). For example, Hai (2003) proposed the mechanism could be built by modeling, controlling, and managing cognitive flow process. Espinosa et al. (2007) argued collaboration performance depends on the interact effects of members' familiarity and task's complexity. Järvelä et al. (2010) emphasized the importance of social influence on collaborative learning effects. They claimed that social aspects, namely, social influence and social construction can sustainably affect motivation in collaborative learning. Thus, this research aims at exploring how information quality controls enhance collaborative learning via social influence and team climate construction.

## Research model and hypotheses

Management controls can be utilized to promote people's advantageous performance, team effectiveness, strategies implementing, and help measure and monitor the outcomes by means of performances measurement or other techniques (Langfield-Smith and Smith 2003; Marginson 2002; Langfieldsmith 1997). As a crucial part of management control, information quality control is a formal control mechanism, which can help distributed team managers conduct comprehensive performance measurement and evaluation processes (Goebel and Weißenberger 2017). In addition, it can also promote the implement of cybernetic systems, such as team communication systems (Malmi and Brown 2008). Thus, it has a direct effect on the outcomes and performance of teamwork, and collaborative learning is a crucial performance in distributed teamwork (Schwartz 1995; Leinonen and Järvelä 2010).

Effective information quality control methods have potential to enhance the levels of collaborative learning. On one hand, Otley (1999) pointed out that at the operational level, learning process needs support from more and more comprehensive information, some management control systems design was adjusted corresponding to this nature of learning. Collaborative learning, as an important outcome in distributed team, makes a request for high level information quality control. On the other hand, the successful implementation of a chosen strategy in an organization or team is possible only if managers can get to the enough relevant information from their groups when they make important decisions (Otley 1999). That can also urge all team members, besides team managers, implementing effective decisions and promote collaborative learning process.

Hence, we proposed: *Hypothesis 1 Information quality control has a positive relationship with collaborative learning.*

In previous literature, management control systems are expected to enhance users' ethical decision processes, promote positive ethical climates and gain benefits from ethical aspects (Gagne et al. 2010; Norris and O'Dwyer 2004; Lindsay et al. 1996; Rosanas and Velilla 2005). For example, Gagne et al. (2010) proposed that there was a need to embed ethical considerations in management control context in order to facilitate blend ethics into team members' daily work. Norris and O'Dwyer (2004) proved informal and formal management controls could cause a dominant influence of socially and ethically responsive decision-making. Jose and Thibodeaux (1999) held that it important to institutionalize ethics in organization through structures, systems, and process controls.

Management controls can construct an ethical workplace environment to provide employees with welfare, show employees worthwhile goals in their own rights, promote their identification with organizational or team goals, and make work more effectively (Chenhall 2004). Goebel and Weißenberger (2017) have proved some management controls can promote positive workplace ethical climate. Meanwhile, information quality control, as a crucial aspect of management controls, can enhance information transparency and outcome feedback via setting up corresponding team rules. When work information can be seen by all collaborative team members, they could perceive a more covenantal and caring relationship between themselves, which could promote a mutual commitment to their common welfare (Barnett and Schubert 2002).

Meanwhile, feedback and transparency control can also make an effect of monitor and provide whistleblowing possibility (Lindsay et al. 1996). Then an environment of high caring ethical climate can be constructed and behavioral constraints against some potential ethical transgressions and deteriorated relations can be achieved (Goebel and Weißenberger 2017; Lindsay et al. 1996; Beu and Buckley 2004).

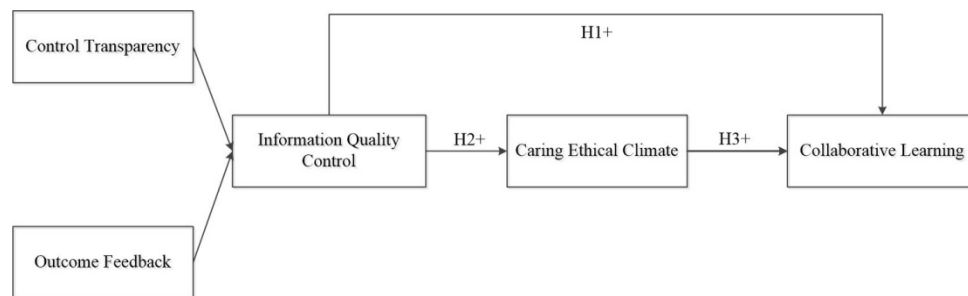
Hence, we proposed: *Hypothesis 2 Information quality control has a positive relationship with caring ethical climate.*

In distributed team context, team members could feel a higher level of perceived support from the whole team if they are in high caring ethical climate (Goebel and Weißenberger 2017). In this case, they are more likely to engage team work to repay back in positive behaviors (Eisenberger et al. 1986). For example, in a team with high caring ethical climate, team rules or inclinations often concern the well-being of all members who might be affected by team members' decisions, actually not only the

rules and inclinations, all members would followed this manner in their behaviors, such as positive engagement and trying best to pay out (Wimbush and Shepard 1994). Goebel and Weißenberger (2017) proposed caring ethical climate could bring major benefits to team performance and these benefits could be understood as an increase of positive behaviors. In previous researches, scholars provided the evidence of the relationships between ethical climate perceptions and individual-level work outcomes (Martin and Cullen 2006). Meanwhile, collaborative learning is a crucial aim and performance of distributed collaborative teamwork (Leinonen and Järvelä 2010; Schwartz 1995), the engagement, effectiveness and efficiency of collaborative learning are all relied on the positive behaviors of members in team with caring ethical climate.

Hence, we proposed: *Hypothesis 3 Caring ethical climate has a positive relationship with collaborative learning.*

Drawing on the literature reviewed above, Figure 1 depicts our research model.



**Figure 1. Research model**

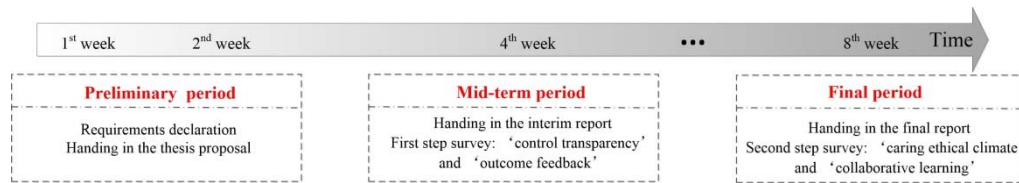
## Research design

### Samples

Data was collected based on a course experiment. The experiment was based on an AACSB tracking course in a famous Chinese business college. During the course experiment, 156 graduate students were divided into 13 teams, and each team was also divided into 3 or 4 groups according to specific division of team. In addition, each team simulated a data consulting firm and the teams were required to collect real data, conduct interviews, analyze data set, present their business prospect, and finish business analysis reports. Unique topic of business case analysis, such as 'e-health', 'online music market', 'cross-border electronic commerce' and so on was given to each team. Students were required to finish collaborative learning online to simulate distributed collaboration scene. Students should hand in thesis proposal, interim report, and final report as bases for their assessments.

We proposed three requirements for process of collaborative learning among students: First, each team must establish their management plans of collaborative learning, including choosing online collaboration tools (such as Slack and Ding Talk), portfolio of the functions in the tools and setting the collaborative rules inside the team and team members should obey these rules (Various topics and tools use could ensure the difference in management control methods and ethical climates among all the teams). Second, all the students were encouraged to follow the ethical principles during collaborative learning, such as ethical point of benevolence. Third, the outcomes should reflect the cognitive depth in business phenomenon with a high-quality, creation of new knowledge is encouraged.

The course lasted for 8 weeks and we conducted a two-step survey to collect data. We sent questionnaires at 4<sup>th</sup> week online to investigate independent variables 'control transparency' and 'outcome feedback' and then, we sent questionnaires at 8<sup>th</sup> week online to investigate other variables. All variables are team members' perceptions since the rich diversities among teams and groups exist in the experiment. The timeline is shown in Figure 2. Finally, we collected 154 samples due to some students' incomplete responds. The average age of the students is 22.4 and there were 114 (74%) responds from female students and 40 (26%) responds from male students.



**Figure 2 Timeline of course experiment**

## Measures

The measures were all adapted from prior studies with each item measured using a seven-point Likert scale with anchors 'strongly disagree/agree'. Four measurements were conducted in this paper, namely perception of control transparency, outcome feedback, caring ethical climate and collaborative learning. Information quality control is the formative variable of control transparency and outcome feedback in data analysis. Measures of control transparency and outcome feedback are from research of Andreas I Nicolaou and McKnight in 2006. Measures of caring ethical climate are from Victor and Cullen's 7-item scale provided in 1988. Measures of collaborative learning are people's perceived levels of computer-mediate collaborative learning 8-item scale from So and Brush's (2008) research.

## Data analysis

We used the partial least squares structural equation modelling (PLS-SEM) path-weighting scheme to analyze the data in this study. Compared with covariance-based structural equation modelling (CB-SEM), PLS-SEM is more appropriate to identify key 'driver' constructs and analyze small-to-medium-sized samples (Hair et al. 2011). And also, formative variable could also be analyzed by PLS-SEM method. We chose PLS-SEM for the advantages above and the analysis tool we chose is Smart PLS 3.0 software. We tested the significance of model with a bootstrap size of 5,000 subsamples.

## Results

### Measurement model

First we tested the indicator validity of formative variable 'information quality control', which are shown in Table 1. Two indicators (control transparency and outcome feedback) are significant and VIFs are both below than 2, which mean a good indicator validity (Chin and Marcoulides 1998). Convergent validity of other variables was measured by Quality Criteria, which are shown in Table 2. For each construct, the average variance extracted (AVE) is higher than 0.7, reflecting a good convergent validity. Construct reliability can be assessed with the composite reliability measure. As Table 1 shown, all constructs exceed the recommended threshold of 0.9. In addition, for each construct, Cronbach's Alpha (Ca) is higher than 0.8, reflecting a good reliability.

Then we evaluated discriminant validity by the criteria of Fornell-Larcker Criterion (FLC). The results are shown in Table 3. For each indicator, the factor AVE extracted the square root reaches the standard. That indicates that each construct also shares more variance with its assigned items than with any other variable, reflecting good discriminant validity (Fornell and Larcker 1981). Moreover, we removed some items with low outer loadings, including CA1, CA2, CA3, CL1, and CL7.

Indicators	Abb.	Path coefficients	Outer loading	T statistics	P-Values	VIF
Control transparency	CT	0.81	0.77	4.77	0.00	1.95
Outcome feedback	OF	0.99	0.95	13.31	0.00	1.95

**Table 1. Indicator validity of formative variable**

Indicators	Abb.	Ca	CR	AVE
Caring ethical climate	CA	0.87	0.91	0.72

Collaborative learning	CL	0.92	0.94	0.72
Information quality control	IQC	-	-	-

**Table 2. Quality criteria**

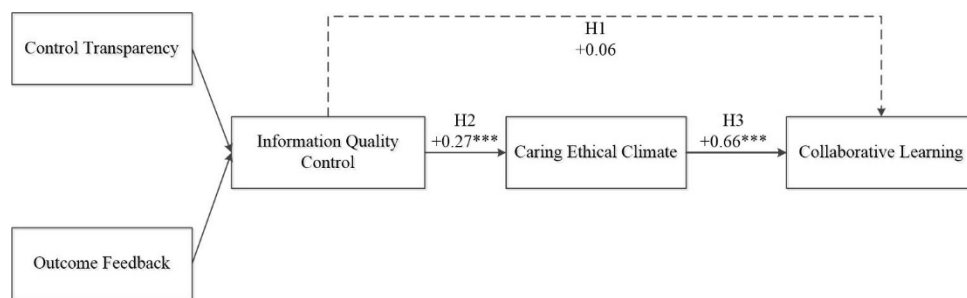
Items	CA	CL	OF
CA	<b>0.85</b>		
CL	0.68	<b>0.85</b>	
IQC	0.27	0.23	-

**Table 3. Fornell-Larcker Criterion****Structure model**

Structural model analysis was conducted next. We tested the significance of model with a bootstrap size of 5,000 subsamples. According to the results of bootstrapping, we got the results of structure model. Two of the three hypotheses (H2 and H3) were supported according to the results. H1 was not supported, which means information quality control do not unexpectedly affect collaborative learning. The results are shown in Table 4. And the visualization of the results is shown in Figure 3. Information quality control affects caring ethical climate significantly and caring ethical climate affects collaborative learning significantly, while information quality control does not have significant relationship with collaborative learning. That means caring ethical climate has a complete mediation effect in the relationship between information quality control and collaborative learning.

Hypothesis	Path coefficient	T statistics	P-value	Result
H1+	0.06	0.84	0.40	Not support
H2+	0.27	4.03	0.00***	Support
H3+	0.66	12.11	0.00***	Support

\*= $p < .05$ ; \*\*= $p < .01$ ; \*\*\*= $p < .001$ ; two-tailed tests

**Table 4. Path coefficient and significance****Figure 3. Visualization of the results****Discussion**

The objectives of the research are to explore whether information quality control could enhance collaborative learning and whether caring ethical climate mediates the relationship between information quality control and collaborative learning in distributed team context since previous researches have not discussed the effects of management controls and ethical climate in distributed teamwork environment. To achieve the objectives, we conducted an experiment in an 8-week course and a 2-round survey. 154 samples were collected and we analyzed the data via PLS method. Results showed a good



validity and reliability. The two of three hypotheses were supported. Our discussion will around the hypotheses.

In general, ethical climate theory worked well in our research and H2 and H3 were supported. On one hand, information quality control has a positive relationship with caring ethical climate. As we proposed, control information quality, enhancing rulemaking of control transparency and outcome feedback, could promote team members' perception of covenantal and caring relationship, and is beneficial to construct caring ethical climate among distributed team. On the other hand, caring ethical climate has a positive relationship with collaborative learning. Members in teams with caring ethical climate could repay their team with high individual-level work outcomes, which reflects by collaborative learning in distributed collaboration team.

H1, information quality control has a positive relationship with collaborative learning, was not supported in our research, which means caring ethical climate is a complete mediation of the relationship between information quality control and collaborative learning. The hypothesis we developed was based on previous opinions that collaborative learning is one of important team performance and empirical results of management controls' direct effects on team outcomes in previous researches. When we considerate the nature of collaborative learning, we argue we could explain the result. Collaborative learning is a cognitive process with social attributes substantially (Alavi 1994). Some previous researches verified the relationship between management control and some kinds of team outcomes (Malmi and Brown 2008), but we cannot ignore the differences between outcomes, like financial performance and non-financial performance (Chenhall 2004). As Chenhall (2004) claimed, there are not compelling evidences to suggest that management controls can link to team outcome directly in some researches. Therefore, when we take the nature of collaborative learning into consideration, we can explain the unsupported hypothesis and the complete mediation effect of caring ethical climate.

## Implications

There are both theoretical and practical implications in this research. For theory, first, this research expands theoretical boundary of ethical climate by apply it to explain distributed team. Although ethical climate theory has been constructed for more than 30 years, changes of team forms due to new technologies development has provided new demands, namely, how the applicability of traditional ethical climate theory to new distributed and online work environment is deserved to be discussed. Then we versified the mediation effect of caring ethical climate of relationship between management control and collaborative learning. Second, this research enriches the theory of ethical climate by fitting in information quality control as the antecedents of ethical climate. Finally, we proposed a new perspective, caring ethical climate, to explain information quality control's effects to collaborative learning.

As for practical implications, first, for software developers, given the popularity of distributed team form in workplace, designing efficient and utility collaboration tools is crucial. Some specific functions and portfolio of functions are helpful to conduct management controls and construct beneficial team climate. For example, the functions like information tracking and real-time monitor can enhance information feedback mechanism and information quality, and then can promote team performance. For team managers, especially in distributed team learning context, on one hand, they are supposed to choose appropriate collaboration tools and their functions to achieve customized management controls objectives. On the other hand, they should realize that only using management control methods cannot always enhance team performance directly, especially performance with cognitive and social nature. Constructing positive team climate, such as caring ethical climate, via making team specific rules can achieve cognitive goals in distributed teamwork efficiently.

## Limitation and future research

There are some limitations and suggestions to future research. First, the samples we used in empirical study were students, which could cause a lack of profession, culture and age diversities. In future study we suggested a more multicomponent sample to avoid potential bias. Second, our empirical study was based on an 8-week course and the time was kind of limited. If the empirical study could last

for a longer time, the results could explain more prolonged phenomena and build a more accurate model. Finally, some other types of ethical climates, besides caring ethical climate, could also be explored in research model, which could provide a more substantial foundation for implications.

## Conclusion

Given emergence of advanced computer-mediated technologies and changed manners of teamwork, it is important to investigate how to utilize management controls to enhance collaborative learning in distributed teams. This research integrated ethical climate theory to distributed team collaboration context and tested caring ethical climate's mediating effect to the relationship between information quality control and collaborative learning. The empirical results verified the complete mediation effect of caring ethical climate and we also gave the reason on non-significant relationship between information control and collaborative learning. We hope this research can foster further ethical perspective in the area of management controls and team collaboration research.

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## References

- Alavi, M. (1994). Computer-Mediated Collaborative Learning: An Empirical Evaluation. *MIS Quarterly*, 18(2), 159-174.
- Ambrose, M. L., Arnaud, A., & Schminke, M. (2008). Individual Moral Development and Ethical Climate: The Influence of Person–Organization Fit on Job Attitudes. *Journal of Business Ethics*, 77(3), 323-333.
- Anderson, N. R., & West, M. A. (1998). Measuring Climate for Work Group Innovation: Development and Validation of the Team Climate Inventory. *Journal of Organizational Behavior*, 19(3), 235-258.
- Arjaliès, D. L., & Mundy, J. (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research*, 24(4), 284-300.
- Bailey, J. E., & Pearson, S. W. (1983). Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science*, 29(5), 530-545.
- Barnett, T., & Schubert, E. (2002). Perceptions of the Ethical Work Climate and Covenantal Relationships. *Journal of Business Ethics*, 36(3), 279-290.
- Beu, D. S., & Buckley, M. R. (2004). Using accountability to create a more ethical climate. *Human Resource Management Review*, 14(1), 67-83.
- Cheng, M. Y., & Wang, L. (2015). The Mediating Effect of Ethical Climate on the Relationship Between Paternalistic Leadership and Team Identification: A Team-Level Analysis in the Chinese Context. *Journal of Business Ethics*, 129(3), 639-654.
- Cheng, X., Fu, S., & Druckenmiller, D. (2017). Trust Development in Globally Distributed Collaboration: A Case of U.S. and Chinese Mixed Teams. *Journal of Management Information Systems*, 33(4), 978-1007.
- Chenhall, R. H. (2004). Management control systems design within its organizational context: findings from contingency-based research and directions for the future. *Accounting Organizations & Society*, 28(2), 127-168.
- Chenhall, R. H., & Morris, D. (1986). The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems. *Accounting Review*, 16-35.
- Chin, W. W., & Marcoulides, G. (1998). The partial least squares approach to structural equation modeling.
- Cullen, J. B., Parboteeah, K. P., & Victor, B. (2003). The Effects of Ethical Climates on Organizational Commitment: A Two-Study Analysis. *Journal of Business Ethics*, 46(2), 127-141.
- Domino, M. A., Wingreen, S. C., & Blanton, J. E. (2015). Social Cognitive Theory: The Antecedents

- and Effects of Ethical Climate Fit on Organizational Attitudes of Corporate Accounting Professionals—A Reflection of Client Narcissism and Fraud Attitude Risk. *Journal of Business Ethics*, 131(2), 453-467.
- Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived Organizational Support. *Journal of Applied Psychology*, 71(3), 500-507.
- Ellison□Potter, P., Bell, P., & Deffenbacher, J. (2010). The Effects of Trait Driving Anger, Anonymity, and Aggressive Stimuli on Aggressive Driving Behavior. *Journal of Applied Social Psychology*, 31(2), 431-443.
- Espinosa, J. A., Slaughter, S. A., Kraut, R. E., & Herbsleb, J. D. (2007). Familiarity, complexity, and team performance in geographically distributed software development. *Organization science*, 18(4), 613-630.
- Finel, B. I., & Lord, K. M. (1999). The Surprising Logic of Transparency. *International Studies Quarterly*, 43(2), 315.
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50.
- Gagne, M. L., Gavin, J. H., & Tully, G. J. (2010). Assessing the Costs and Benefits of Ethics: Exploring a Framework. *Business & Society Review*, 110(2), 181-190.
- Goebel, S., & Weißenberger, B. E. (2017). The Relationship Between Informal Controls, Ethical Work Climates, and Organizational Performance. *Journal of Business Ethics*, 141(3), 505-528.
- Hai, Z. (2003). Workflow- and agent-based cognitive flow management for distributed team Cooperation. *Information & Management*, 40(5), 419-429.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory & Practice*, 19(2), 139-152.
- Järvelä, S., Volet, S., & Järvenoja, H. (2010). Research on Motivation in Collaborative Learning: Moving Beyond the Cognitive–Situative Divide and Combining Individual and Social Processes. *Educational Psychologist*, 45(1), 15-27.
- Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is anybody out there?: antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14(4), 29-64.
- Jose, A., & Thibodeaux, M. S. (1999). Institutionalization of Ethics: The Perspective of Managers. *Journal of Business Ethics*, 22(2), 133-143.
- Kenneth, A., Stede, & Der, W. A. V. (2011). Management control systems : performance measurement, evaluation, and incentives. *Journal of Accounting & Organizational Change*, 28(2), 47.
- Langfield-Smith, K., & Smith, D. (2003). Management control systems and trust in outsourcing relationships. *Management Accounting Research*, 14(3), 281-307.
- Langfieldsmith, K. (1997). Management control systems and strategy: A critical review. *Accounting Organizations & Society*, 22(2), 207-232.
- Leinonen, P., & Järvelä, S. (2010). Facilitating interpersonal evaluation of knowledge in a context of distributed team collaboration. *British Journal of Educational Technology*, 37(6), 897-916.
- Lindsay, R. M., Lindsay, L. M., & Irvine, V. B. (1996). Instilling ethical behavior in organizations: A survey of Canadian companies. *Journal of Business Ethics*, 15(4), 393-407.
- Lowry, P. B., & Jr, J. F. N. (2005). Using Internet-Based, Distributed Collaborative Writing Tools to Improve Coordination and Group Awareness in Writing Teams. *IEEE Transactions on Professional Communication*, 46(4), 277-297.
- Malmi, T., & Brown, D. A. (2008). Management control systems as a package—Opportunities, challenges and research directions. *Management Accounting Research*, 19(4), 287-300.
- Marginson, D. E. (2002). Management control systems and their effects on strategy formation at middle□management levels: evidence from a UK organization. *Strategic management journal*, 23(11), 1019-1031.
- Martin, K. D., & Cullen, J. B. (2006). Continuities and Extensions of Ethical Climate Theory: A Meta-Analytic Review. *Journal of Business Ethics*, 69(2), 175-194.
- Merchant, K. A., & Otle, D. T. (2006). A Review of the Literature on Control and Accountability. *Handbooks of Management Accounting Research*, 2(2), 785-802.
- Nicolaou, A. I., & McKnight, D. H. (2006). Perceived information quality in data exchanges: Effects on risk, trust, and intention to use. *Information systems research*, 17(4), 332-351.
- Nicolaou, A. I., & Mcknight, D. H. (2011). System Design Features and Repeated Use of Electronic

- Data Exchanges. *Journal of Management Information Systems*, 28(2), 269-304.
- Norris, G., & O'Dwyer, B. (2004). Motivating socially responsive decision making: the operation of management controls in a socially responsive organisation. *British Accounting Review*, 36(2), 173-196.
- Otley, D. (1999). Performance management: a framework for management control systems research. *Management Accounting Research*, 10(4), 363-382.
- Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833-848.
- Rosanas, J. M., & Velilla, M. (2005). The Ethics of Management Control Systems: Developing Technical and Moral Values. *Journal of Business Ethics*, 57(1), 83-96.
- Schneider, B. (1975). Organizational climates: An essay 1. *Personnel psychology*, 28(4), 447-479.
- Schwartz, D. L. (1995). The Emergence of Abstract Representations in Dyad Problem Solving. *Journal of the Learning Sciences*, 4(3), 321-354.
- Serçe, F. C., Swigger, K., Alpaslan, F. N., Brazile, R., Dafoulas, G., & Lopez, V. (2011). Online collaboration: Collaborative behavior patterns and factors affecting globally distributed team performance. *Computers in Human Behavior*, 27(1), 490-503.
- Simha, A., & Cullen, J. B. (2012). Ethical climates and their effects on organizational outcomes: Implications from the past and prophecies for the future. *Academy of Management Perspectives*, 26(4), 20-34.
- So, H. J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, 51(1), 318-336.
- Victor, B., & Cullen, J. B. (1988). The Organizational Bases of Ethical Work Climates. *Administrative Science Quarterly*, 33(1), 101-125.
- Whipple, W. R. (1987). Collaborative Learning: Recognizing It When We See It. *Aahe Bulletin*, 6.
- Wimbush, J. C., & Shepard, J. M. (1994). Toward an understanding of ethical climate: Its relationship to ethical behavior and supervisory influence. *Journal of Business Ethics*, 13(8), 637-647.
- Zhang, X., Meng, Y., de Pablos, P. O., & Sun, Y. (2017). Learning analytics in collaborative learning supported by Slack: From the perspective of engagement. *Computers in Human Behavior*, 92, 625-633.