

The Effect of Psychological Safety on Innovation Behavior: A Meta-Analysis

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ABSTRACT

This meta-analysis examines the relationship between psychological safety and innovation behavior and explores potential moderators that may moderate the relationship: cultural context and team type. A total of 94 independent samples of 85 articles meet the inclusion criteria (N=19180) through literature screening. The results of this study indicate that psychological safety has a significant effect on employee innovation behavior ($r=0.299$) and team innovation behavior ($r=0.435$); in addition, we found that cultural background moderate the relationship between psychological safety and employee innovation behavior; and team type moderate the relationship between psychological safety and team innovation behavior. In summary of the results, this meta-analysis highlights the impact of psychological safety on different contexts of innovation behavior and also provides a reference for future psychological safety research.

Keywords: *psychological safety; innovation behavior; meta-analysis; moderating effects*

1. INTRODUCTION

With the rapid development of the knowledge economy, the complex, volatile and competitive external environment has contributed to insecure psychological states such as depression, anxiety and panic among individuals [1], and consequently to ineffective employee behavior, thus creating barriers to personal and organizational development. At the same time, in order for companies to gain a competitive advantage in this turbulent environment, stimulating individual innovation behavior and enhancing team and organizational innovation has become an important cornerstone of development. Psychological safety, as a positive cognitive state, refers to the individual's perception that relationships are safe and necessary for personal growth, learning and effective work [2], and is also an important factor in promoting healthy team and organizational development [3]. Thus, psychological safety and innovation behavior have an inextricable theoretical relationship and practical implications.

In recent years, research on the relationship between psychological safety and innovation behavior has received extensive attention in the field of organizational

management research. Although a growing number of studies have enriched human resource management research, there are also problems with inconsistent results of empirical analysis. Firstly, there are two different findings of positive and negative correlations between psychological safety and innovation behavior. Secondly, the strength of the relationship between psychological safety and innovation behavior also varies considerably. Therefore, there are different effects of psychological safety on different innovation behaviors, and it is important to clarify the relationship between psychological safety and innovation behaviors.

This study uses a meta-analytic approach to comprehensively assess the nature and strength of the relationship between psychological safety and innovation behavior, and to explore the potential moderating variables between the two: cultural background, and team type, in order to provide scientific suggestions for future research.

2. RESEARCH HYPOTHESIS

2.1 Main effects

Previously, there has been a large body of research

demonstrating that psychological safety is related to innovation behavior, such as the team adaptation theory which suggests that psychological safety makes innovation behavior possible; innovation occurs more frequently if people feel safe. Therefore, this study concluded that there is a positive relationship between psychological safety and innovation behavior.

An atmosphere of psychological safety encourages team members to ask questions, seek feedback, openly discuss their mistakes, and reflect on alternative perspectives [4], thus daring both sides of knowledge transfer to be proactive, facilitating knowledge sharing within the team, and ultimately facilitating innovative organizational change.

The impact of psychological safety on individual learning [5] and team learning [4] has been widely recognized. Psychologically safe workplaces allow employees to overcome anxiety and fear of failure, to proactively seek help, to raise errors and concerns, and to achieve innovative and boundary-crossing behavior [6]. Thus, allowing employees to focus on learning new competencies and improving their work rather than worrying about how others will react to their behavior.

When faced with psychological threats and psychological insecurity, individuals are more likely to develop defensive orientations and less likely to display creative and innovation behavior at work. Therefore, when individual employees feel psychologically safe and willing to seek help from others without fear that their expressions will negatively affect interpersonal relationships, they are more likely to develop a high level of engagement in their creative work attempts, which is ultimately an important manifestation of creativity [5].

Based on the above analysis, hypotheses 1 and 2 were formulated for this study.

Hypothesis 1: Psychological safety positively influences employee innovation behavior.

Hypothesis 2: Psychological safety positively influences team innovation behavior.

2.2 Moderating effects

Team type. A knowledge-based team is a dynamic collective whose members are diverse in their knowledge areas, task-oriented, and form the core competencies of the team by sharing the resources, knowledge and skills they possess. Factors such as clear team goals, team design [7] (including access to a wealth of resources, information and contextual support such as rewards) can be a constant stimulus to increase the psychological security of employees in knowledge-based teams. Due to the consistency of team goals and clear task perceptions, continuous resource mastery and capacity expansion, knowledge-based team members are more willing to engage in proactive behaviors such as communication,

learning and knowledge sharing, resulting in a positive team innovation climate.

Therefore, the following hypothesis is proposed in this study.

Hypothesis 3: Team type has a moderating effect on the positive relationship between psychological safety and team innovation behavior, and there is a more significant positive relationship between psychological safety and team innovation behavior in knowledge-based teams compared to non-knowledge-based teams.

Cultural background. Organizational members behave differently in organizations due to the cultural context and geographical location in which they are located. Researchers have long argued that national culture may influence organizational work outcomes [8], and there have also been calls to examine the role of national culture in feelings of psychological safety [2].

According to social exchange theory, different cultural dimensions, such as power distance and uncertainty avoidance, may influence individuals' levels of psychological safety. In Eastern cultures, organizational power distance is high, interpersonal relationships are complex, and employees are biased towards collectivism and highly influenced by their environment whereas Western cultures have lower power distance, place more emphasis on individualism, promote rationality, focus on their autonomy and participation in decision-making, and place less importance on interpersonal interactions and emotional connections in the pursuit of personal interests. As a result, in Western cultures, employees and teams are more likely to establish a climate of psychological safety and are more inclined to engage in communication, suggestion, learning, feedback and other behaviors that are conducive to innovation for themselves and their teams.

Therefore, the following hypothesis is proposed in this study.

Hypothesis 4: Cultural background has a moderating effect on the positive relationship between psychological safety and employee innovation behavior, and there is a more significant positive relationship between psychological safety and employee innovation behavior in Western cultures than in Eastern cultures.

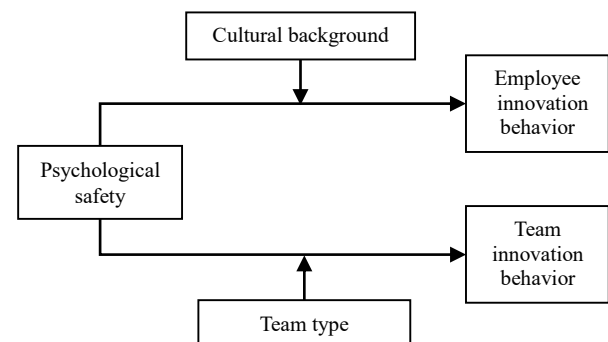


Figure 1 Research model

3. RESEARCH METHOD

3.1 Literature Search

This study conducted an electronic search of Chinese and English literature. The Chinese literature search included CNKI database, National Center for Philosophical and Social Sciences Literature, Baidu Academic, and China Social Science Citation Index; the English database search included Web of Science, EBSCO, PsycInfo, and Google Scholar; the search terms used included Psychological Safety, Psychological Safety climate, innovation behavior, creativity, Motivation to share, knowledge sharing, learning behavior. The search results include journal articles, conference papers, dissertations and more. As Edmondson's (1999) psychological safety scale is used for most psychological safety measures, this study also used the online database to identify any articles that cited Edmondson (1999).

3.2 Data Analysis

In performing the meta-analysis calculations, this study used the procedure established by Hunter and Schmidt (2004) to perform statistical analyses using CMA 2.0, a software dedicated to meta-analysis. The results of this study summarize the sample size-weighted average estimate (r) of the correlation coefficient. Confidence intervals were calculated using the method recommended by Lee (1989), which uses the square root of the inverse of the total sample size for each study as the standard deviation for each combination of variables. 95% confidence intervals were obtained by multiplying the standard deviation by 1.96 and then adding or subtracting the results based on the mean correlation. When studies did not report correlation coefficients, but only regression coefficients, this study transformed the regression coefficients by the formula, with the following conversion formula: $r = \beta \times 0.98 + 0.05$ ($\beta \geq 0$); $r = \beta \times 0.98 - 0.05$ ($\beta < 0$) ($\beta \in (-0.5, 0.5)$).

4. RESULTS

4.1 Homogeneity Test

The homogeneity test is the first step in a meta-analysis study. Homogeneity tests are conducted using the general linear model procedure of statistical analysis systems. The homogeneity test explores whether differences in study results can be explained by measuring sample differences between studies, and homogeneity

analysis examines differences in the absolute value of correlations without regard to the sign associated with the various correlations. As the studies included in the meta-analysis had to be independent of each other, tests of whether individual studies were independent of each other were necessary. If heterogeneity existed across studies, a random effects model was used for the meta-analysis.

The results of the homogeneity test showed that the sample size for psychological safety and employee innovation behavior was 51, Q value = 477.578 and Df value was 50, with a p -value < 0.001 , so heterogeneity existed and differences in the results of different studies could be explained by differences in the sample between measurements and studies. The sample size for the psychological safety and team innovation behavior study was 43, $Q=163.058$, Df value was 42, p -value < 0.001 , so there was heterogeneity and differences in results across studies could be explained by differences in samples between measurements and studies.

Therefore, a random effects model was used for both main effects studies.

4.2 Publication Bias

The results of the publication bias test for this meta-analysis are shown in Figures 2 and 3. funnel plots are an important tool for testing whether publication bias is present. In Figures 2 and 3, the vertical axis in the middle of the funnel plot represents the value of the combined effect sizes. In Figure 2, each study point is clustered at the top of the funnel plot, and in Figure 3, only one point is not at the top of the funnel plot and has a symmetrical pattern at both ends of the vertical axis, indicating that there is no bias. Also, fail-safe N values - the number of studies needed to turn a study finding insignificant - can be used to test for publication bias. research by Viechtbauer (2007) clarifies that publication bias may be present when fail-safe N values are less than $5K+10$ (K is the sample size) situation. Using the N values entered in Table 2, the fail-safe coefficient between psychological safety and employee innovation behavior is 16865, much greater than 225 ($K=43$); and the fail-safe coefficient between psychological safety and team innovation behavior is 9429, greater than the corresponding critical value of 225 ($K=43$).

Based on the above results, it can be judged that there is no risk of publication bias in the conclusions of the meta-analysis of this paper.

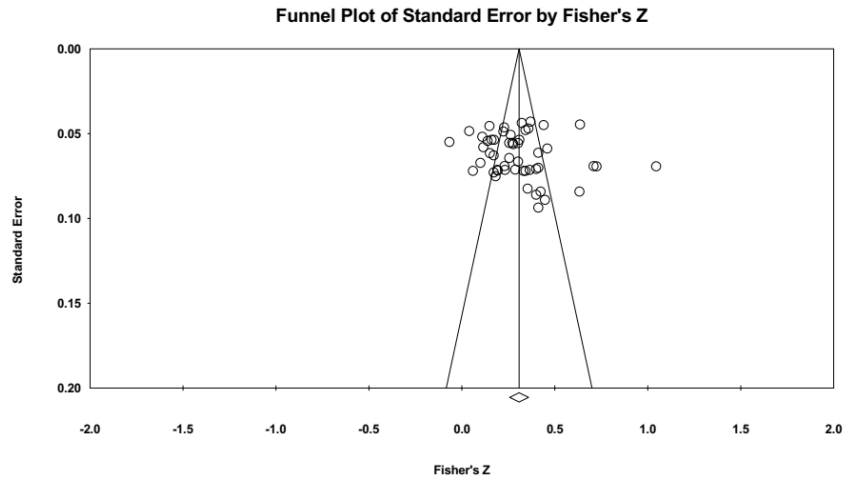


Figure 2 Distribution of effect values of employee innovation behavior

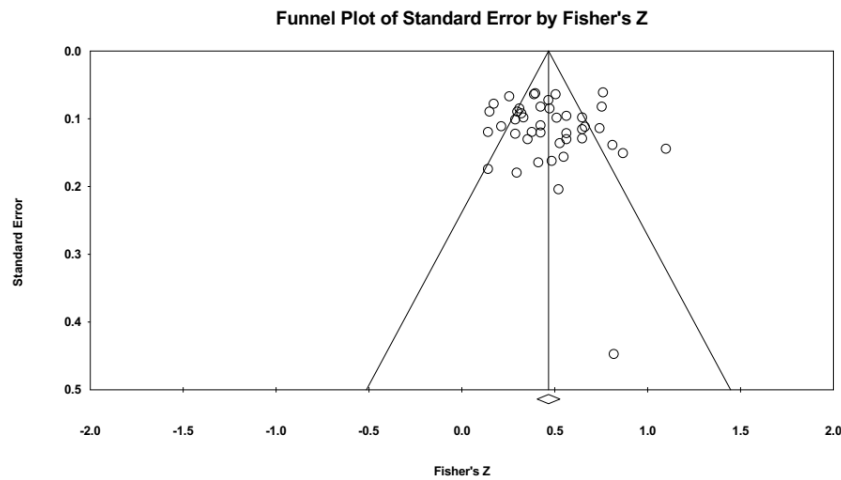


Figure 3 Distribution of effect values of team innovation behavior

4.3 Results of main effects

Table 1 shows that a total of 51 studies were included in the analysis of the effect of psychological safety and employee innovation behavior, with a total sample size of 14,672, an effect value of 0.299 for the main effect, a 95% confidence interval of (0.252,0.344) and a Z value of 11.892 for the two-tailed test, $p < 0.001$, indicating that psychological safety is moderately related to employee innovation behavior. Therefore, this study confirms that there is a significant positive effect between psychological safety and employees' innovation behavior, and hypothesis 1 holds. In the study of the effect of psychological safety and team innovation behavior, a total of 43 sets of effect values were included in the analysis, with a total sample size of 4508. the main effect had an effect value of 0.435, a 95% confidence interval of (0.384,0.484) and a two-tailed test z-value of 14.959, $p < 0.001$, demonstrating that psychological safety is moderately related to team innovation behavior. Therefore, this meta-analysis confirmed the positive effect of psychological safety on team innovation behavior, and hypothesis 2 was supported.

Table 1 The effect of psychological safety on innovation behavior

Variables	Model	K	N	$\mu\rho$	95% CI	Two-tailed test	
						Z-value	P-value
Employee Innovation Behavior	Random	51	14672	0.299	(0.252,0.344)	11.892	<0.001
Team Innovation Behavior	Random	43	4508	0.435	(0.384,0.484)	14.959	<0.001

4.4 Results of moderating effects

This paper examines the moderating effects of two moderators - team type, and cultural background - on the relationship between psychological safety and employee innovation behavior and team innovation behavior.

The study coded the sample respondents into knowledge-based and non-knowledge-based teams based

on team type. The results of the meta-analysis showed that the moderating effect of team type on the relationship between psychological safety and team innovation behavior was significant ($p=0.017$) and hypothesis 3 was supported.

Western cultural backgrounds, including the USA,

UK, Israel and Spain, and Eastern cultural backgrounds, including China and Korea, were studied. The results in Table 2 show that the moderating effect of cultural background on the relationship between psychological safety and employee innovation behavior is significant ($p=0.005$) and Hypothesis 4 is supported.

Table 2 Effect of moderating factors

Variables	Moderators	Type	Homogeneity			K	N	μ	ρ	95%CI	Two-tailed test	
			Qb	df	p						Z-value	P-value
Team Innovation Behavior	Team Type	Non-knowledge-based team	5.720	1	0.017	20	2179	0.372	(0.296, 0.444)	8.891	<0.001	
		Knowledge-based team				23	2329	0.486	(0.426, 0.541)	10.152	<0.001	
Employee Innovation Behavior	Cultural Background	Eastern culture	8.010	1	0.005	42	12713	0.225	(0.218, 0.292)	13.068	<0.001	
		Western culture				9	1959	0.483	(0.334, 0.608)	5.750	<0.001	

5.DISCUSSION

The concept of psychological safety has been proposed for more than 50 years, and domestic research on psychological safety has been developed for more than 30 years, but until now, systematic and quantitative reviews of psychological safety are still relatively rare. This study collated and summarized the impact of psychological safety on outcome variables related to innovation behavior through a meta-analysis of 94 studies conducted over 30 years at home and abroad. The study found that psychological safety was positively associated with both employee innovation behavior and team innovation behavior, i.e. individuals and teams with high psychological safety exhibited more significant individual and team innovation behavior at work. The results are also consistent with the performance of several previous studies [7].

Therefore, this study concluded that psychological safety was a significant antecedent variable in predicting innovation behavior and further observed the relationship between psychological safety and employee innovation behavior ($r = 0.299$) and team innovation behavior (0.435) and found some differences between the two. This meta-analysis did not confirm the reasons for the differentiation in the relationship between psychological safety and employee innovation behavior and team innovation behavior, nor was a comparison made. Therefore, future comparisons of the effects of psychological safety on different levels of innovation behavior are expected to enrich and deepen the study.

In addition, this study addresses the importance of the moderating effect.

Previous research has focused on the mechanisms of the effect of psychological safety on innovation behavior in a particular group of knowledge-based teams, and there is a lack of in-depth exploration and validation. Knowledge-based teams have equality between superiors and subordinates, and knowledge-based employees have

higher self-fulfillment needs, more resources, knowledge and skills. The equal collision of multiple knowledge contributes to the transfer of internal knowledge, which is a necessary condition for innovation behavior to arise. The results of the meta-analysis indicate that the relationship between psychological safety and team innovation behavior in knowledge-based teams is significant. However, whether individual employees demonstrate innovation is more influenced by individual employee characteristics than by team innovation behavior, and is more difficult to achieve uniformity at the group level. Therefore, the relationship between psychological safety and innovation behavior in knowledge-based teams can be further tested in the future when research findings are complete and more enriched.

The moderating role of cultural background has not been previously confirmed by research. Most studies have focused on only one country due to difficulties in cross-cultural data collection, but the relationship between psychological safety and innovation behavior may be influenced by different cultural contexts. Most of the existing observations of moderating factors focus on the meso level, such as group structural characteristics, leadership behavior and interpersonal relationships, and the variables of interest can reflect significant differences across cultural contexts. The results of the meta-analysis confirm that the relationship between psychological safety and employee innovation behavior is moderated by cultural context. However, whether the team as a whole demonstrates innovation may be affected by multiple influences of the organization and the context in which the team is placed, as opposed to employee innovation behavior. Therefore, the relationship between cultural context on psychological safety and team innovation behavior can be further verified in the future when research findings are more refined and enriched.

6.CONCLUSION

Through the collection and collation of existing literature, this study proposes that psychological safety

can positively influence two main effects of employee innovation behavior and team innovation behavior. In the context of high psychological safety, through successful information exchange and knowledge sharing within the organization, knowledge is repeatedly learnt and regenerated within the team, and the team and its members can develop their own knowledge base and develop new solutions through what they have learnt, enhancing individual and team creativity and enabling the organization to have good innovation behavior outcomes.

This study verifies the main effects of psychological safety on employee innovation behavior and team innovation behavior through a meta-analytic approach and examines the moderating effects of team type and cultural context on the relationship between psychological safety and employee innovation behavior and team innovation behavior. The results show that psychological safety is an important construct at both the individual and group levels, and that it has a significant positive impact on employee innovation behavior and team innovation behavior, while being subject to various moderating factors. By summarizing the existing research findings and exploring several important issues, this study pushes psychological safety research forward and points out the gaps that need to be filled and the directions that can be further explored in future research. It is hoped that this study will encourage more scholars to delve into the role of psychological safety in the workplace.

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