

The Journal of Behavioral Science (TJBS)

Quantitative Research Article

Error Management Climate as a Driver of Employee Innovation Behavior: The Mediating Role of Psychological Empowerment

Zhangnan Luo¹, Vesarach Aumeboonsuke¹, Jiafu Su^{2*}

Abstract

Background/problem: Organizations increasingly recognize that innovation depends not only on formal R&D investments but also on individual employees' innovative behaviors. However, the organizational conditions that foster such behaviors remain incompletely understood.

Objective/purpose: This study explores the relationship between the error management climate and innovation behavior among junior employees in China's small and medium-sized game software development enterprises by collecting data from these employees, with psychological empowerment as a mediating mechanism.

Design and Methodology: Drawing on error management theory, psychological empowerment theory, and innovation research, this study developed and tested a mediation model using survey data from 479 junior employees in China. Structural equation modeling and bootstrap mediation analysis were employed to test the hypothesized relationships.

Results: Learning from errors showed the largest indirect effect on innovation behavior through psychological empowerment (indirect effect = .08, 95% CI [.03, .14], $p = .00$). Thinking about errors also demonstrated a significant indirect effect (0.06, 95% CI [.03, .11], $p = .00$). Error competence (0.07, 95% CI [0.03, 0.13], $p = .00$) and error communication (0.05, 95% CI [0.01, 0.11], $p = .01$) both showed significant indirect effects despite their non-significant direct effects.

Conclusion and Implications: These findings highlight the psychological mechanisms through which an organizational atmosphere that tolerates errors promotes innovation, and indicate that enterprises should create a tolerance-for-errors environment to enhance the empowerment and innovative behavior of junior employees, especially those who may be more sensitive to the signals of the organizational atmosphere.

Author Affiliation

¹ International College, National Institute of Development Administration, Thailand.
² International College, Krirk University, Thailand.

*Corresponding author e-mail: sjf1987@ctbu.edu.cn
https://orcid.org/0000-0002-6001-5744

Article Information

Received: 02.04.26
Revised: 23.04.26
Accepted for Review: 23.04.26

Keywords

Error management climate, game software industry, innovation behavior, psychological empowerment

In today's rapidly evolving business environment, organizational innovation has become critical for competitive advantage and long-term survival (Almrshed et al., 2023). This is particularly true in knowledge-intensive industries such as game software development, where technological advances, shifting consumer preferences, and intense competition demand continuous innovation. The global game industry has grown exponentially, with revenues exceeding \$200 billion annually, driven primarily by innovative products and business models.

Within organizations, innovation increasingly depends not only on formal R&D efforts but also on the innovative behaviors of individual employees at all organizational levels (Jun & Lee, 2023). Employee innovation behavior, encompassing the generation, promotion, and implementation of novel ideas, has emerged as a critical driver of organizational innovation outcomes. However, fostering innovation behavior among employees, particularly those in junior positions, presents significant challenges for organizations.

Recent research has identified organizational climate as a key factor shaping employee innovation behavior (Peng & Jia, 2023). Among various climate dimensions, error management climate has emerged as particularly relevant for innovation. Error management climate refers to shared organizational practices and norms regarding the handling of errors, including the extent to which errors are viewed as learning opportunities, communicated openly, and used to improve organizational processes. Since innovation inherently involves experimentation and risk-taking that inevitably produce errors and failures, organizations that punish errors may inadvertently suppress the experimentation necessary for innovation.

While the conceptual link between error management and innovation appears intuitive, empirical research examining this relationship remains limited, particularly regarding the underlying mechanisms. Error management research has traditionally focused on safety outcomes in high-reliability organizations, while systematic investigation of error management climate's effects on innovation behavior in creative industries remains scarce (Kleinschmidt et al., 2025). Furthermore, the psychological processes through which organizational error tolerance translates into individual innovative behaviors have not been adequately explored.

This study addresses these gaps by examining psychological empowerment as a key mediating mechanism linking error management climate to innovation behavior. Psychological empowerment, characterized by employees' intrinsic task motivation reflected in meaning, competence, self-determination, and impact (Özcan et al., 2025), may explain how organizational practices translate into proactive, innovative behaviors. This paper proposes that error management climate fosters psychological empowerment by creating psychological safety, enhancing perceived competence through learning opportunities, granting autonomy, and demonstrating meaningful impact, which in turn motivates employees to engage in innovation behavior. Meanwhile, this study examines the impact of an error management climate on employees' innovative behaviors, analyzes the differentiated effects of different dimensions, tests the mediating role of psychological empowerment, and explores the motivational mechanism by which organizational atmosphere transforms into individual innovative behaviors. This paper conducts an empirical study to examine the direct relationship between the atmosphere of error management and employees' innovative behaviors. It investigates the differentiated impacts of the four dimensions of the error management climate on innovative behaviors. It examines the mediating role of psychological empowerment in connecting the error management climate and innovative behaviors. Based on the self-determination theory, it provides a theory-driven explanation of how organizational atmosphere influences innovation through intrinsic motivation.

The game industry, as a typical creative-intensive industry, innovation is its core competitiveness. The game development process itself is highly uncertain, with rapid iterations and frequent trial-and-error, and mistakes and failures are inevitable (Mumtaz et al., 2022). This makes the role of the error management atmosphere particularly prominent. Especially in the Chinese context, game enterprises are in a critical period of transformation from "traffic-driven" to "content-driven". The tightening of license approval and strict regulatory environment have further exacerbated the conservative mentality of practitioners, who are afraid of taking responsibility, dare not make mistakes, and tend to cover up errors. Chinese game practitioners are mainly composed of young, highly educated, and creativity-driven knowledge workers. They are highly sensitive to organizational atmosphere and have a strong demand for psychological empowerment (Zhang & Wang, 2025). This makes this intermediary path more easily captured and verified. Therefore, the mechanism of "error management atmosphere-psychological empowerment-innovative behavior" has the strongest theoretical compatibility and the most urgent practical explanatory power in the Chinese game industry. It provides a precise theoretical lens for solving the management dilemmas commonly faced by Chinese game enterprises, such as lack of innovation and absence of error tolerance. By focusing on junior employees in small and medium-sized game software enterprises in China, this study makes several contributions. First, this study extends error management theory beyond its traditional safety focus to demonstrate its relevance for innovation outcomes. Second, this study identifies error management climate as an important antecedent of psychological empowerment. Third, this study uncovers

psychological empowerment as a key mediating mechanism explaining how error management climate influences innovation behavior. Fourth, this study provides insights into cultivating innovation among junior employees who may be particularly sensitive to organizational climate signals. Finally, this study tests the cross-cultural applicability of Western-developed theories in the Chinese game software industry context.

Literature Review

In order to better understand how the error management climate affects innovation behavior this section will review the relevant theoretical foundations and empirical evidence. Based primarily on the creativity component theory, this review first explains the application of the creativity component theory in innovation behavior. Subsequently, it elaborates on the mediating role of psychological empowerment in connecting the error management climate with innovation behavior, and integrates these mechanisms into a mediating framework.

Creativity Component Theory

Socio-environmental influences can significantly influence creativity, but clearly, they are only one decisive force. At the same time as the development of the social psychology of creativity, psychologists from many subdisciplines have theorized about how creativity occurs and what influences it. In order to avoid theoretical fragmentation, Amabile et al. (1996) proposed the creativity component theory based on social psychology. The creative component holds that the process of producing creativity includes individual elements and external environment elements. Individual elements refer to domain-related skills, creativity-related processes, and task-related motivations. Domain related skills include an individual's knowledge, skills, and talents in a specific field. Creative-related processes refer to the cognitive styles and working styles that are conducive to the output of innovative thinking, such as creative self-efficacy. This style is influenced by acquired skills training and activity experience; Task-related motivation plays a significant role in individual creativity.

Over the past 25 years, the creative component theory has been tested and expanded in a wide range of psychological studies. One of the most interesting developments is the discovery of creatively-related processes at the team level (and possibly at the organizational level) to complement those at the individual level in the original theory. For example, Taggar (2002) studied how personality traits and group processes affect creativity in small groups on open-ended tasks. The results support and extend the various parts of the component model. Not only do individual differences correlate with creative output in predictable ways, but there is also evidence for “team creativeness related processes”: a team's ability to work together effectively and make the best use of each member's skills.

Based on Amabile et al. (1996) componential theory of creativity, creativity is a multiplicative function of domain skills, creativity-related skills, work motivation, and social environment. And the four variables of error management precisely constitute the complete operationalization path of this theory. Psychological empowerment activates intrinsic work motivation through meaning and autonomy, providing the driving force for creativity. Thinking about errors cultivates creative cognitive styles through attribution analysis and reflective thinking, forging creativity-related skills (Groves & Vance, 2025). Learning from errors transforms failure experiences into transferable domain knowledge, enriching the domain skill reserve.

Error Management Climate and Psychological Empowerment

Error management climate is the embodiment of organizational error management practice in organizational culture. The management atmosphere of an organization is an intuitive feeling of the members to the characteristics of the working environment of the organization and the ways of interaction and cooperation among the members. Psychological empowerment refers to an internal motivational state or cognitive complex (Blume et al., 2024).

Learning from errors refers to the process where individuals or organizations actively identify, analyze past mistakes and failures, and extract useful knowledge and experience from them in order to improve future behaviors and decisions (Qudrat-Ullah, 2025). This message increases the perceived meaningfulness of work by aligning work activities with learning and development values that many employees hold personally. Second, regarding competence, error management climate should directly enhance employees' sense of competence through multiple mechanisms. The thinking about errors creates opportunities to develop new skills, acquire knowledge, and improve performance through systematic reflection on what went wrong and how to do better. Research has shown that psychological safety enables the very trial-and-error learning processes through which expertise is built (Wang et al., 2025). Regarding self-determination, error management climate should enhance autonomy perceptions by granting employees discretion in how they detect, respond to, and learn from errors. The error communication dimension also enhances self-determination by creating horizontal information sharing among peers, reducing dependence on hierarchical information channels and enabling more autonomous problem-solving. Fourth, regarding impact, error management climate should strengthen employees' sense that their actions matter and make a difference. Based on these arguments, it is proposed the following hypotheses:

- H1: Error management climate positively affects psychological empowerment.
- H1a: Learning from errors positively affects psychological empowerment.
- H1b: Thinking about errors positively affects psychological empowerment.
- H1c: Error competence positively affects psychological empowerment.
- H1d: Error communication positively affects psychological empowerment.

Error Management Climate and Innovation Behavior

Individual innovation, as an internal driving force, reflects an individual's active acceptance and pursuit of new things and changes (Alam, 2025). In the discussion of employee innovation behavior, many scholars have given in-depth elaboration from different angles. According to classic studies of Amabile (1988), employee innovation behavior is not only a dynamic process, involving innovative ideas generated by employees in the execution of work and their specific practices, but also a static result, which is reflected in the actual results brought by these innovative behaviors. The learning from errors dimension encourages experimentation, a core component of the innovation process. When employees know that failures will be analyzed for learning rather than punished, they become more willing to take the calculated risks necessary for innovation (Geng et al., 2022). The thinking about errors dimension promotes cognitive elaboration, systematic analysis, and creative problem-solving. Based on the above analysis, it is proposed the following hypotheses:

- H2: Error management climate positively affects innovation behavior.
- H2a: Learning from errors positively affects innovation behavior.
- H2b: Thinking about errors positively affects innovation behavior.
- H2c: Error competence positively affects innovation behavior.
- H2d: Error communication positively affects innovation behavior.

Psychological Empowerment and Innovation Behavior

Psychologically empowered employees should exhibit higher levels of innovation behavior for several reasons. The meaning dimension of empowerment creates intrinsic motivation to engage in innovation. When employees experience their work as meaningful and aligned with their values, they are more likely to invest discretionary effort in improvement activities like innovation (Nawaz et al., 2023). The competence dimension provides the self-efficacy necessary to tackle the challenging, uncertain tasks involved in innovation. Employees who feel competent are more likely to persevere through the obstacles and failures inherent in innovation processes (Alam, 2025). Based on the above discussion, it is proposed the following hypothesis:

- H3: Psychological empowerment positively affects innovation behavior.

Mediating Role of Psychological Empowerment

This study propose that psychological empowerment mediates the relationship between error management climate and innovation behavior, meaning that error management climate influences innovation primarily by fostering psychological conditions that motivate and enable innovative activities (Elsayed et al., 2023). This mediation hypothesis rests on the logic that error-tolerant organizational climates create psychological experiences of empowerment, which in turn drive the proactive, discretionary behaviors associated with innovation (Lin et al., 2023). Error management climate operates primarily through psychological rather than purely behavioral mechanisms, it shapes how employees think and feel about their work roles, which then influences what they do (Horvath et al., 2023). Based on the above analysis, it is proposed the following hypotheses:

H4: Psychological empowerment mediates the relationships between error management climate dimensions and innovation behavior.

H4a: Psychological empowerment mediates the learning from errors-innovation behavior relationship.

H4b: Psychological empowerment mediates the thinking about errors-innovation behavior relationship.

H4c: Psychological empowerment mediates the error competence-innovation behavior relationship.

H4d: Psychological empowerment mediates the error communication-innovation behavior relationship.

The conceptual model summarizing these hypothesized relationships is presented in Figure 1.

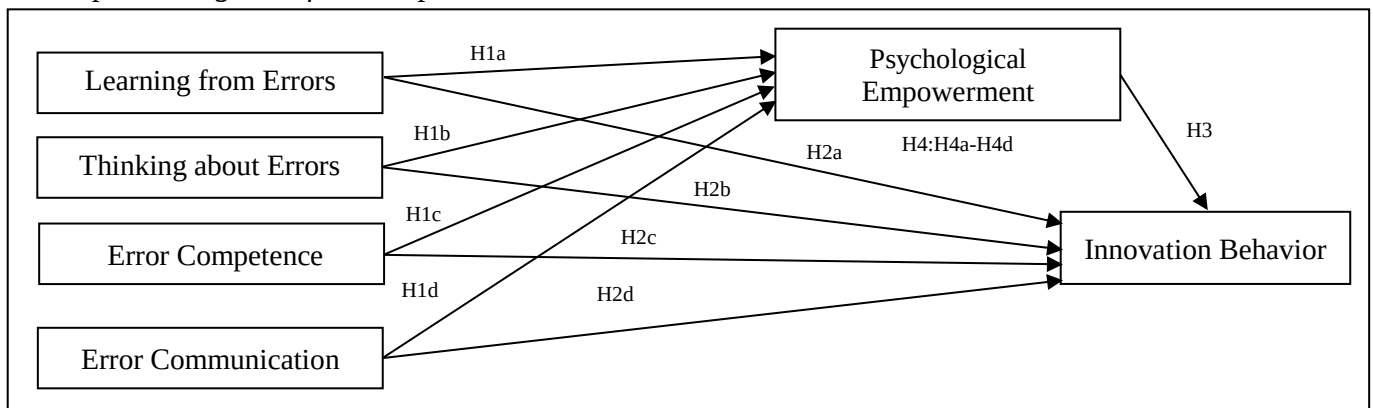
Method

Research Design

This study employed a quantitative cross-sectional survey design to test the proposed mediating model. The data were collected from junior employees of small and medium-sized game software development enterprises in China.

Figure 1

Conceptual Diagram of the Proposed Model



Research Context and Sample

The game industry, as a typical creative-intensive industry, innovation is its core competitiveness. The game development process itself is a highly uncertain, rapid iteration, and frequent trial-and-error process. Errors and failures are inevitable, which makes the role of the error management atmosphere particularly prominent. At the same time, the practitioners in the game industry are mainly young, highly educated, and driven by creativity, knowledge workers. They are highly sensitive to organizational atmosphere and have a strong perception of psychological empowerment. The mediating effect of psychological empowerment is more easily captured and verified. Currently, game enterprises generally face management challenges such as employees covering up errors due to fear of accountability and not daring to innovate. This makes the “error management atmosphere-psychological empowerment-

innovative behavior” mechanism have the strongest theoretical compatibility and the most urgent practical explanatory power in this industry.

From January to February 2026, this research collected relevant data from junior employees of small and medium-sized game software development enterprises in China. This work defined junior employees as those with less than five years of total work experience, regardless of their tenure with the current organization. This operationalization captures employees who are relatively early in their careers and may be particularly responsive to organizational climate signals while potentially facing barriers to expressing innovative ideas. This work focused on small and medium-sized enterprises (SMEs) with fewer than 300 employees because these organizations often depend heavily on employee innovation for competitive advantage, may have less formalized innovation structures than large corporations, and represent the majority of game development companies in China (Gentile-Lüdecke et al., 2020).

Participants were recruited from game software development companies located in four major Chinese cities: Beijing, Shanghai, Shenzhen, and Chengdu. These cities were selected because they represent major hubs of China’s game software industry, collectively accounting for the majority of game development activity, employment, and revenue in the country. Beijing and Shanghai are established centers with large numbers of companies and skilled talent pools. Shenzhen has emerged as a mobile gaming powerhouse with particular strength in social and casual games. Chengdu has grown rapidly as a game development center, attracting companies seeking lower costs while accessing growing talent from regional universities. Sampling across these diverse locations enhances the generalizability of findings beyond any single city’s unique characteristics (Griffith, 2013).

Data Collection

Online questionnaires were distributed through professional survey platforms and industry social media channels including specialized gaming industry forums and professional networking groups. To enhance response rates and data quality, this work implemented several procedures. First, personalized invitation messages emphasized the study’s focus on understanding how junior developers’ innovative potential can be better supported. Second, confidentiality and anonymity were guaranteed, with participants informed that individual responses would never be shared with employers and that only aggregate, de-identified results would be reported. Third, small monetary incentives (approximately \$5 USD equivalent) were offered to participants who completed the survey. Fourth, reminder messages were sent to non-respondents at one-week and two-week intervals. Fifth, attention check items were embedded in the questionnaire to identify careless responding.

Of 546 questionnaires distributed, 500 responses were received, representing a 91.58% initial response rate. However, 21 responses were excluded during data screening, resulting in 479 valid responses (95.8% valid response rate). Exclusions were based on the following criteria: 12 responses failed attention checks (e.g., “Please select ‘Strongly Agree’ for this item”), 6 responses had excessive missing data (>10% of items missing), and 3 responses showed straight-lining patterns (identical responses across all items). These screening procedures are standard practice for ensuring data quality in survey research (Podsakoff et al., 2003).

The final sample of 479 participants comprised 67.2% male and 32.8% female respondents, broadly consistent with gender distributions in the Chinese game software industry. Regarding age, 43.8% were 26-30 years old, 36.5% were 18-25, 17.3% were 31-35, and 2.3% were over 35. Educational attainment was high, with 50.9% holding bachelor’s degrees, 37.4% holding master’s degrees, 9.0% holding associate degrees, and 2.7% holding doctoral degrees, reflecting the knowledge-intensive nature of game software development. Work experience distribution showed 52.0% with 1-3 years of experience, 28.6% with less than 1 year, 13.4% with 3-5 years, and 6.1% with more than 5 years (the latter group included because they joined the game industry recently despite having prior experience in other fields). Company size distribution showed 61.8% working in medium-sized companies (100-300 employees) and 38.2% in small companies (<100 employees). Geographical distribution across the four cities was relatively balanced: Beijing (31.3%), Chengdu (25.5%), Shenzhen (21.7%), and Shanghai (21.5%).

Measures

All constructs were measured using established scales with demonstrated reliability and validity. Items were originally developed in English and were translated into Chinese using standard back-translation procedures. Two bilingual researchers independently translated items from English to Chinese. Discrepancies were resolved through discussion. A third bilingual researcher blinds to the original English items back-translated the Chinese version to English. The back-translated and original English versions were compared and any inconsistencies were addressed through iterative revision of the Chinese translation. All items used 5-point Likert scales (1 = strongly disagree, 5 = strongly agree) unless otherwise noted (Mazurek et al., 2021).

Error Management Climate

Error management climate was measured using the 16-item scale developed and validated by Van Dyck et al. (2005). The scale comprises four four-item subscales assessing learning from errors (e.g., “After an error has occurred, it is carefully analyzed”), thinking about errors (e.g., “We think about how errors can be avoided”), error competence (e.g., “We can deal with errors well”), and error communication (e.g., “Errors are discussed openly”). Note that in the original scale Van Dyck et al. (2005), the thinking about errors dimension contains 5 items while error competence contains 3 items. Cronbach’s α values in our sample were: learning from errors ($\alpha = .91$), thinking about errors ($\alpha = .90$), error competence $\alpha = .86$, and error communication ($\alpha = .87$), all exceeding the .70 threshold for acceptable reliability.

Psychological Empowerment

The assessment of psychological empowerment employed the widely used 16-item scale developed by Spreitzer (1995), which consists of four 4-item sub-scales, each assessing different aspects such as meaning (e.g., “The work I do is meaningful to me”), ability (e.g., “I am confident in my ability to complete the work”), autonomy (e.g., “I have considerable autonomy in deciding how to carry out the work”), and influence (e.g., “I have a significant impact on what happens in the department I am in”). Following standard practice, we aggregated across the four dimensions to create an overall psychological empowerment score, as the dimensions are theorized and have been empirically shown to combine additively to create a holistic empowerment construct. Cronbach’s α for the overall scale was .93.

Innovation Behavior

Innovation behavior was measured using a 13-item scale adapted from Janssen (2000) and Scott and Bruce (1994), assessing idea generation (e.g., “I generate creative ideas”), idea search (e.g., “I search out new working methods, techniques, or instruments”), idea communication (e.g., “I champion innovative ideas”), and implementation activities (e.g., “I transform innovative ideas into useful applications”). Cronbach’s α was .92.

Analytical Strategy

Data analysis proceeded in several stages using SPSS 28.0 and AMOS 28.0 software. First, this study conducted descriptive statistical analyses, examined variable distributions for normality, and calculated correlations among study variables. Second, this paper performed confirmatory factor analysis (CFA) to verify the measurement model and assess convergent and discriminant validity. Third, we tested for common method bias using Harman’s single-factor test. Fourth, this paper estimated a structural equation model to test the hypothesized direct relationships (H1-H3). Fifth, this work conducted Bootstrap mediation analysis with 5,000 resamples to test indirect effects (H4a-H4d) following procedures recommended by (Preacher & Hayes, 2008).

Results

Descriptive Statistics, Correlations, and Preliminary Analyses

Descriptive statistics for all study variables are presented in Table 1. All variables displayed moderate to moderately high means ranging from 3.45 to 3.72 on the 5-point scale, suggesting that participants generally perceived moderate-to-high levels of error management climate, psychological empowerment,

and innovation behavior in their organizations. Standard deviations ranged from .58 to .79, indicating acceptable variability in responses. Examination of skewness and kurtosis values revealed all variables fell within acceptable ranges for approximate normal distributions ($|\text{skewness}| < 2.0$, $|\text{kurtosis}| < 7.0$), supporting the appropriateness of maximum likelihood estimation in structural equation modeling.

Table 1*Descriptive Statistics for Variables*

Variable	<i>n</i>	Min	Max	Mean	SD	Skewness	Kurtosis
Learning from Errors	479	1.00	5.00	3.58	.77	-.25	-.05
Thinking about Errors	479	1.20	5.00	3.46	.73	-.03	-.13
Error Competence	479	1.00	5.00	3.54	.79	-.09	-.24
Error Communication	479	1.00	5.00	3.45	.74	-.17	-.02
Psychological Empowerment	479	1.88	5.00	3.70	.58	-.21	.01
Innovation Behavior	479	2.00	5.00	3.72	.60	-.18	-.01

Descriptive statistics and correlations among study variables are presented in Table 2. All variables displayed moderate to moderately high means ranging from 3.45 to 3.72, with standard deviations from 0.58 to 0.79, indicating acceptable variability in responses.

As shown in Table 2, correlation analysis revealed that all study variables were significantly and positively intercorrelated ($p < .001$), providing preliminary support for the hypothesized relationships. Error management climate dimensions correlated positively with psychological empowerment ($r = .38$ to $.47$) and innovation behavior ($r = .33$ to $.46$). Psychological empowerment showed a strong correlation with innovation behavior ($r = .53$, $p < .001$). Among error management climate dimensions, Learning from Errors demonstrated the strongest correlations with both psychological empowerment ($r = .47$) and innovation behavior ($r = .46$). Importantly, no correlation exceeded .90, indicating absence of multicollinearity concerns.

Table 2*Means, Standard Deviations, and Correlations*

Variable	Mean	SD	1	2	3	4	5	6
1. Learning from Errors	3.58	.77	1					
2. Thinking about Errors	3.46	.73	.38***	1				
3. Error Competence	3.54	.79	.42***	.30***	1			
4. Error Communication	3.45	.74	.42***	.32***	.32***	1		
5. Psychological Empowerment	3.70	.58	.47***	.39***	.41***	.38***	1	
6. Innovation Behavior	3.72	.60	.46***	.38***	.36***	.33***	.53***	1

Note: All correlations significant at $p < 0.001$, $n = 479$.

Measurement Model Assessment

Confirmatory factor analysis (CFA) was conducted using AMOS 28.0 to assess the measurement model's fit to the data. As shown in Table 3, the results demonstrated excellent fit across all indices: $\chi^2/df = 1.18$ (< 3.0), GFI = .95, CFI = .99, NFI = .95, TLI = .99, AGFI = .94, IFI = .99 (all $> .90$), and RMSEA = .02 ($< .05$), meeting all recommended thresholds (Hu & Bentler, 1999). These results provide strong evidence that the hypothesized measurement model adequately represents the observed data, supporting the validity of the factor structure.

Table 3*Confirmatory Factor Analysis*

Indicator	χ^2/df	GFI	RMSEA	CFI	NFI	TLI	AGFI	IFI
Standard*	< 3	$> .9$	$< .05$	$> .9$	$> .9$	$> .9$	$> .9$	$> .9$
Value	1.18	.95	.02	.99	.95	.99	.94	.99

Note. *These standards are suggested by Fornell and Larcker (1981).

As shown in Table 3, the results demonstrated excellent fit across all indices: $\chi^2/df = 1.18 (<3.0)$, GFI = .95, CFI = .99, NFI = .95, TLI = .99, AGFI = .94, IFI = .99 (all $>.90$), and RMSEA = .02 ($<.05$), meeting all recommended thresholds. These results provide strong evidence that the hypothesized measurement model adequately represents the observed data, supporting the validity of the factor structure.

Table 4
Convergent Validity

Factor	Item	Std. Estimate	AVE	CR
Learning from Errors	EML1	.83	.71	.91
	EML2	.81		
	EML3	.88		
	EML4	.85		
Thinking about Errors	EMT1	.80	.64	.90
	EMT2	.80		
	EMT3	.78		
	EMT4	.78		
	EMT5	.84		
Error Competence	ECM1	.81	.68	.86
	ECM2	.83		
	ECM3	.83		
Error Communication	ECO1	.81	.62	.87
	ECO2	.77		
	ECO3	.80		
	ECO4	.77		
Psychological Empowerment	Meaning	.69	.52	.81
	Competence	.75		
	Self-determination	.76		
	Impact	.70		
Innovation Behavior	Idea Generation	.69	.53	.82
	Idea Search	.75		
	Idea Communication	.74		
	Implementation Activities	.74		

Note. EML=Learning from Errors, EMT=Thinking about Errors, ECM=Error Competence, ECO=Error Communication.

As presented in Table 4, all indicator variables loaded significantly on their respective latent constructs ($p < .001$), with standardized loadings ranging from .69 to .88, all exceeding the .60 threshold recommended for acceptable convergent validity. Composite reliability (CR) values ranged from .86 to .92, well above the .70 criterion. Average variance extracted (AVE) values ranged from .62 to .71, exceeding the .50 threshold (Fornell & Larcker, 1981). These results provide strong evidence of convergent validity.

Table 5
Discriminant Validity

Dimension	Learning from Errors	Thinking about Errors	Error Competence	Error Communication	Psychological Empowerment	Innovation Behavior
Learning from errors	.84					
Thinking about errors	.38	.80				
Error competence	.42	.29	.82			
Error communication	.42	.32	.32	.79		
Psychological empowerment	.47	.40	.41	.38	.72	
Innovation behavior	.46	.38	.36	.33	.53	.73

For discriminant validity, we examined whether the square root of each construct's AVE exceeded its correlations with other constructs. As shown in Table 5, this criterion was met for all constructs, supporting discriminant validity. The diagonal elements in Table 5 represent the square root of AVE for each construct (ranging from .72 to .84), all of which exceeded the off-diagonal correlation coefficients with other constructs, confirming that each construct shares more variance with its own indicators than with other constructs.

Structural Model and Hypotheses Testing

Structural equation modeling was conducted using AMOS 28.0 to test the hypothesized relationships among error management climate, psychological empowerment, and innovation behavior.

The structural equation model demonstrated excellent fit (see Table 6). χ^2/df was 1.20, well below the recommended threshold of 3.0, indicating good model fit. The goodness-of-fit index (GFI = .95), comparative fit index (CFI = .99), normed fit index (NFI = 0.96), Tucker-Lewis index (TLI = 0.99), adjusted goodness-of-fit index (AGFI = 0.94), and incremental fit index (IFI = 0.99) all exceeded the recommended threshold of 0.90. The root mean square error of approximation (RMSEA = .02) was substantially below the 0.05 threshold for excellent fit. Collectively, these indices demonstrate that the structural model fits the data well, supporting the validity of the hypothesized relationships.

Table 6

Structural Equation Model Fitting

Indicator	χ^2/df	GFI	RMSEA	CFI	NFI	TLI	AGFI	IFI
Standard	<3.00	>.90	<.05	>.90	>.90	>.90	>.90	>.90
Value	1.20	.95	.02	.99	.96	.99	.94	.99

Regarding hypothesis 2, the results were mixed (see Table 7). Learning from errors ($\beta = .20$, SE = .04, CR = 3.29, $p < .01$) and thinking about errors ($\beta = .13$, SE = .04, CR = 2.51, $p < .05$) demonstrated significant positive effects on innovation behavior, supporting H2a and H2b. However, error competence ($\beta = .08$, SE = .04, CR = 1.35, $p > .05$) and error communication ($\beta = 0.03$, SE = .04, CR = .48, $p > .05$) did not show significant direct effects on innovation behavior, failing to support H2c and H2d. These non-significant direct effects, coupled with the significant effects on psychological empowerment found for H1c and H1d, suggest that error competence and error communication may influence innovation behavior exclusively through indirect pathways mediated by psychological empowerment, a possibility examined in subsequent mediation analyses.

Hypothesis 3 predicted that psychological empowerment would positively predict innovation behavior. As shown in Table 7, this hypothesis received strong support: $\beta = .42$, SE = .07, CR = 5.89, $p < .001$. The standardized coefficient of .42 indicates that psychological empowerment was the strongest predictor of innovation behavior in the model, exceeding the effects of individual error management climate dimensions. This finding underscores the critical role of empowerment as a proximal motivational state driving innovation behavior.

Table 7

Structural Model Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	Std. β	S.E.	C.R.	Result
H1a	Learning $\rightarrow$ PE	.27***	.04	4.52	Supported
H1b	Thinking $\rightarrow$ PE	.21***	.04	3.95	Supported
H1c	Competence $\rightarrow$ PE	.24***	.04	4.28	Supported
H1d	Communication $\rightarrow$ PE	.16**	.04	2.97	Supported
H2a	Learning $\rightarrow$ IB	.20**	.04	3.29	Supported
H2b	Thinking $\rightarrow$ IB	.13*	.04	2.51	Supported
H2c	Competence $\rightarrow$ IB	.08	.04	1.35	Not Supported
H2d	Communication $\rightarrow$ IB	.03	.04	0.48	Not Supported

H3	PE → IB	.42***	.07	5.89	Supported
----	---------	--------	-----	------	-----------

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, PE = Psychological Empowerment, IB = Innovation Behavior.

Mediation Analysis

To test Hypotheses 4a-4d regarding the mediating role of psychological empowerment, this work conducted Bootstrap mediation analysis with 5,000 resamples following procedures recommended by Preacher and Hayes (2008). Bootstrap methods are preferred over traditional approaches (e.g., Sobel test) because they do not assume normally distributed sampling distributions of indirect effects and provide more accurate Type I error rates. As shown in Table 8, the indirect effects, bootstrap standard errors, and 95% bias-corrected confidence intervals are presented. Following established conventions, an indirect effect is considered statistically significant if its 95% confidence interval does not include zero.

Table 8

Mediation Analysis Results

Hypothesis	Indirect Path	Effect	Boot SE	95% CI	Result
H4a	Learning → PE → IB	.08	.03	[.03, .14]	Supported
H4b	Thinking → PE → IB	.06	.02	[.03, .11]	Supported
H4c	Competence → PE → IB	.07	.03	[.03, .13]	Supported
H4d	Communication → PE → IB	.05	.03	[.01, .11]	Supported

Note. CI = Confidence Interval. Significant if CI does not include zero. PE = Psychological Empowerment; IB = Innovation Behavior.

All four hypothesized indirect effects were statistically significant (see Table 8). Learning from errors showed the largest indirect effect on innovation behavior through psychological empowerment (indirect effect = .08, 95% CI [.03, .14], $p = .001$), supporting H4a. Thinking about errors also demonstrated a significant indirect effect (.06, 95% CI [.03, .11], $p = .001$), supporting H4b. Error competence (.07, 95% CI [.03, .13], $p = .001$) and error communication (.05, 95% CI [.01, .11], $p = .01$) both showed significant indirect effects despite their non-significant direct effects, supporting H4c and H4d. These results indicate that psychological empowerment fully mediates the relationships between error competence and innovation behavior, and between error communication and innovation behavior. For learning from errors and thinking about errors, psychological empowerment partially mediates their effects on innovation behavior, as both direct and indirect effects are significant.

Discussion and Conclusion

Discussion of Main Results

This study, from the perspective of the creativity component theory (Amabile et al., 1996), confirmed the framework of error management climate-psychological empowerment-behavior. This study examined the relationship between error management climate and innovation behavior among junior employees in small and medium-sized game software enterprises, with psychological empowerment as a mediating mechanism. The findings provide substantial support for the proposed theoretical model, with 11 out of 13 hypotheses receiving empirical support. These results make several important contributions to error management theory, psychological empowerment theory and innovation research, while also offering actionable insights for organizational practice.

The findings indicate that psychological empowerment mediates the relationships between error management climate dimensions and innovation behavior. This model is consistent with the results of previous studies, indicating that the error management climate is essentially a fault-tolerant culture at the organizational level, functioning as an external environmental signal. It cannot directly drive employees' innovative behaviors on its own (Horvath et al., 2023). According to the theory of creativity by Amabile et al. (1996), the social environment impacts creativity primarily by influencing an individual's intrinsic work motivation. Psychological empowerment precisely acts as the core psychological mechanism in this

“transformation” process. When an organization creates an open atmosphere for error communication and encourages learning from mistakes, employees will internalize the cognition that “my work is meaningful, I have the ability to cope with challenges, I have the space for autonomous decision-making, and my actions can have an impact”. These four dimensions respectively activate intrinsic motivation, self-efficacy for innovation, and psychological security, thereby transforming the organizational fault-tolerant culture into individual “willingness to innovate, ability to innovate, and courage to innovate” practical actions. The important point is that this study found that the effects of each dimension of the error management climate were not consistent. Specifically, the mediating model showed that error competence and error communication produced a complete mediating effect through psychological authorization, while learning from errors and thinking about errors influenced innovation through partial mediating effects, indicating that these dimensions affect innovation through both direct cognitive pathways and indirect psychological pathways. This conditional model indicates that psychological authorization is not a universal necessary mechanism for all dimensions of the error management atmosphere, but distinguishes to what extent each dimension relies on the internalization process to generate innovation (Frese & Keith, 2015).

This intermediary mechanism can be explained by integrating the componential theory of creativity proposed by Amabile et al. (1996) and self-determination theory. Amabile et al. (1996) argued that social environmental factors influence creativity through work motivation, whereas self-determination theory suggests that psychological empowerment satisfies employees’ three basic psychological needs, namely autonomy, competence, and relatedness, thereby activating intrinsic motivation. For junior employees in game software enterprises, fostering an organizational climate that encourages error learning, promotes error reflection, develops error-solving capabilities, and creates opportunities for error communication can enhance psychological empowerment. Without psychological empowerment serving as an internal psychological mechanism, even a highly supportive error management climate may not be effectively transformed into innovative behavior (Chen et al., 2021).

Finally, this study made a novel theoretical contribution by providing empirical evidence for the framework of “error management climate-psychological empowerment-innovative behavior” in an unexplored context, the entry-level employees in the Chinese game software industry. Out of the 13 hypotheses, 11 were empirically supported, including the complete mediation of error ability and error communication, as well as partial mediation of error learning and error reflection. This study advanced the error management theory, indicating that psychological empowerment is not only one of the many possible mediators but also the core psychological mechanism through which organizational error atmosphere is transformed into individual innovation. Moreover, by examining the moderating effects of employee levels and industry contexts, this study expanded the psychological empowerment theory beyond its traditional Western large-scale organizational context, providing cross-cultural generalization evidence, and offering operational practical insights for organizations that wish to utilize error management to drive innovation.

Limitations and Future Research Directions

Several limitations qualify the interpretation and generalizability of findings. First, the cross-sectional research design precludes definitive causal inferences. While structural equation modeling tested directional hypotheses based on theoretical reasoning and temporal logic, data were collected at a single time point. It is conceivable that reverse or reciprocal causation operates. Future research should employ longitudinal designs measuring error management climate, psychological empowerment, and innovation behavior at multiple time points, allowing tests of temporal precedence and stronger causal inferences.

Second, all the data were collected through self-report questionnaires, which may raise concerns about common method bias. However, statistical tests (Harman’s test) indicated that this issue was within an acceptable range (Podsakoff et al., 2003). Self-reported innovation behavior may be subject to social desirability bias, leniency bias, or differences in individuals’ standards for what constitutes innovation. Future studies should incorporate multiple data sources such as supervisor ratings of innovation behavior, peer nominations of innovative employees, objective innovation metrics, or performance data on innovation-related outcomes.

Third, the sample was limited to junior employees in small and medium-sized game software enterprises in China, which may restrict generalizability. Future research should examine whether findings extend to senior employees (Horvath et al., 2023), large organizations, other industries, and other cultural contexts. Comparative studies across these dimensions would illuminate boundary conditions and contextual contingencies (Podsakoff et al., 2003).

Conclusion

This study examined the key issue of how the error management climate within an organization affects the innovative behavior of junior employees. The results show that psychological empowerment fully mediates this relationship. Notably, error competence and error communication had no significant direct effects on innovation behavior, but both indirectly promoted innovation through enhanced psychological empowerment. These findings contribute to theory by moving beyond simple direct-effect models and uncovering psychological empowerment as a critical mediating mechanism through which an error-tolerant climate fosters innovation. The organization should focus on establishing a supportive environment for error management, with particular emphasis on enhancing the error handling capabilities of managers and facilitating error communication channels. It should not merely rely on verbal encouragement of trial and error, as these two aspects are the key levers for stimulating employees' psychological empowerment and driving innovation. Managers also need to recognize that the paths of effectuation in different dimensions of error management vary. They should specifically enhance the opportunities for junior employees to learn and reflect from errors, thereby effectively transforming them into innovative behaviors by enhancing their sense of meaning, competence, and autonomy.

Declarations

Conflicts of Interest: The authors declare no conflicts of interest.

Ethical Approval Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Basic Education Research Ethics Committee of International College, Krirk University, Thailand for studies involving humans (protocol code 2025M1505, approved on Dec 20, 2025).

Use of AI in the Paper: During the preparation of this work, the authors used generative AI tools (namely Deepseek) only for language editing, including grammar checking and improving sentence clarity. All conceptual development, data analysis, creation of figures and tables, interpretation of results, and theoretical arguments were conducted exclusively by the authors.

References

- Alam, M. Z. (2025). Freedom fuels innovation: Activating personality through trait activation using blessings of goal-setting freedom for intrapreneurial behaviour. *International Journal of Innovation Science*. <https://doi.org/10.1108/IJIS-09-2024-0259>
- Almrshed, S. K. H., Jasim, H. M., & Hassan, A. S. (2023). The effect of innovation management on sustainable competitive advantage in contemporary organizations. *Journal of Law and Sustainable Development*, 11(11), e1980. <https://doi.org/10.55908/sdgs.v11i11.1980>
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw, & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). JAI Press.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, 39(5), 1154–1184. <https://doi.org/10.5465/256995>
- Blume, B. D., Ford, J. K., & Huang, J. L. (2024). Transfer of informal learning: The role of manager support in linking learning to performance. *Business Horizons*, 67(2), 125–136. <https://doi.org/10.1016/j.bushor.2023.12.001>
- Chen, Y., Wei, J., Zhang, J., & Li, X. (2021). Effect mechanism of error management climate on innovation behavior: An investigation from Chinese entrepreneurs. *Frontiers in Psychology*, 12, 733741. <https://doi.org/10.3389/fpsyg.2021.733741>
- Elsayed, A. M., Zhao, B., Goda, A. E. M., & Elsetouhi, A. M. (2023). The role of error risk taking and perceived organizational innovation climate in the relationship between perceived psychological

- safety and innovative work behavior: A moderated mediation model. *Frontiers in Psychology*, 14, 1042911. <https://doi.org/10.3389/fpsyg.2023.1042911>
- Frese, M., & Keith, N. (2015). Action errors, error management, and learning in organizations. *Annual Review of Psychology*, 66, 661–687. <https://doi.org/10.1146/annurev-psych-010814-015205>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.1177/002224378101800104>
- Geng, Z., Xiao, M., Tang, H., M Hite, J., & J Hite, S. (2022). Tolerate to innovate: An expectancy-value model on error management culture and radical creativity. *Management Decision*, 60(7), 2042–2059. <https://doi.org/10.1108/md-03-2021-0387>
- Gentile-Lüdecke, S., Torres de Oliveira, R., & Paul, J. (2020). Does organizational structure facilitate inbound and outbound open innovation in SMEs? *Small Business Economics*, 55(4), 1091–1112. <https://doi.org/10.1007/s11187-019-00175-4>
- Griffith, D. A. (2013). Establishing qualitative geographic sample size in the presence of spatial autocorrelation. *Annals of the Association of American Geographers*, 103(5), 1107–1122. <https://doi.org/10.1080/00045608.2013.776884>
- Groves, K. S., & Vance, C. M. (2025). Avoiding critical entrepreneurial cognitive errors through linear/nonlinear thinking style balance. *Journal of Small Business Management*, 63(2), 872–898. <https://doi.org/10.1080/00472778.2024.2363837>
- Horvath, D., Keith, N., Klamar, A., & Frese, M. (2023). How to induce an error management climate: Experimental evidence from newly formed teams. *Journal of Business and Psychology*, 38(4), 763–775. <https://doi.org/10.1007/s10869-022-09835-x>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Janssen, O. (2000). Job demands, perceptions of effort-reward fairness and innovative work behaviour. *Journal of Occupational and Organizational Psychology*, 73(3), 287–302. <https://doi.org/10.1348/096317900167038>
- Jun, K., & Lee, J. (2023). Transformational leadership and followers' innovative behavior: Roles of commitment to change and organizational support for creativity. *Behavioral Sciences*, 13(4), 320. <https://doi.org/10.3390/bs13040320>
- Kleinschmidt, N., Weiss, L., Stubner, S., Gast, J., & Steinhoff, M. M. (2025). Antecedents, enablers and outcomes of twin transformation in high reliability organizations: A systematic literature review. *Review of Managerial Science*. <https://doi.org/10.1007/s11846-025-00955-1>
- Lin, M., Xie, M., & Li, Z. (2023). Organizational error tolerance and change-oriented organizational citizenship behavior: Mediating role of psychological empowerment and moderating role of public service motivation. *Psychology Research and Behavior Management*, 16, 4133–4153. <https://doi.org/10.2147/PRBM.S431373>
- Mazurek, J., Rico, C. P., García, C. F., Magnot, J. P., & Magnot, T. (2021). The 5-item Likert scale and percentage scale correspondence with implications for the use of models with (fuzzy) linguistic variables. *Revista de Métodos Cuantitativos Para la Economía y la Empresa*, 31, 3–16. <https://doi.org/10.46661/revmetodoscuanteconempresa.4010>
- Nawaz, A., Soomro, S. A., & Mansoor Kundi, Y. (2023). Linking engagement for innovation with innovative performance: The role of discretionary efforts and knowledge-sharing behaviour. *International Journal of Innovation Management*, 27(06), 2350027. <https://doi.org/10.1142/S1363919623500275>
- Özcan, M., Çekmecelioğlu, H. G., & Konakay, G. (2025). Reflections of self-concept clarity at work: The mediating role of psychological empowerment on the relationship between self-concept clarity and intrinsic motivation. *BMC Psychology*, 13(1), 470. <https://doi.org/10.1186/s40359-025-02800-2>
- Peng, L., & Jia, R. (2023). Exploring the interplay of the physical environment and organizational climate in innovation. *Sustainability*, 15(20), 15013. <https://doi.org/10.3390/su152015013>

- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. <https://doi.org/10.3758/brm.40.3.879>
- Qudrat-Ullah, H. (2025). Learning from mistakes. In H. Qudrat-Ullah (Ed.), *Mastering decision-making in business and personal life: An interdisciplinary perspective on making better choices* (pp. 363–400). Palgrave Macmillan. https://doi.org/10.1007/978-3-031-81068-8_11
- Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, 37(3), 580–607. <https://doi.org/10.5465/256701>
- Spreitzer, G. M. (1995). Psychological empowerment in the workplace: Dimensions, measurement, and validation. *Academy of Management Journal*, 38(5), 1442–1465. <https://doi.org/10.5465/256865>
- Taggar, S. (2002). Individual creativity and group ability to utilize individual creative resources: A multilevel model. *Academy of Management Journal*, 45(2), 315–330. <https://doi.org/10.5465/3069349>
- Van Dyck, C., Frese, M., Baer, M., & Sonnentag, S. (2005). Organizational error management culture and its impact on performance: A two-study replication. *Journal of Applied Psychology*, 90(6), 1228–1240. <https://doi.org/10.1037/0021-9010.90.6.1228>
- Wang, Q., Zhang, X., Zhang, N., & Su, J. (2025). Error management climate, psychological security, and employee bootleg innovation behavior: The moderating role of risk-taking traits. *Frontiers in Psychology*, 16, 1538584. <https://doi.org/10.3389/fpsyg.2025.1538584>