INNOVATION CLIMATE AND TEACHERS' INNOVATIVE WORK BEHAVIOR IN SECONDARY SCHOOLS IN QINGDAO, CHINA

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ABSTRACT

This research investigated the levels of innovation climate and teachers' innovative work behavior, as well as their relationship among secondary-school teachers in Qingdao, China. Employing correlational quantitative research, 400 participants (evenly split between junior and senior secondary schools) were recruited via quota convenience sampling, with sample size determined by Krejcie and Morgan (1970). The bilingual 39-item questionnaire used a five-point Likert scale, adapted from established instruments by Scott and Bruce (1994), Anderson and West (1998), and Janssen (2000). Cronbach's alpha coefficients indicated good reliability: .911 for the innovation climate scale and .877 for the innovative work behavior scale. Data were analysed using descriptive statistics and Pearson product-moment correlation at the .05 significance level. Results revealed a high-level innovation climate ($M = 3.70$, $SD = 0.52$), where collegial support scored highest and encouragement of openness scored lowest. Teachers' innovative work behavior also reached a high level ($M = 3.78$, $SD = 0.45$), with idea generation the strongest dimension and idea promotion the weakest. Innovation climate exhibited a moderate positive significant association with teachers' innovative work behavior ($r = .580$, $p < .001$), explaining 33.59 % shared variance. All four climate factors showed significant zero-order positive correlations, led by leadership support for innovation ($r = .571$). When controlling for the other three climate factors in multiple regression, three factors remained statistically significant: leadership support for innovation ($\beta = .388$, $p < .001$), encouragement of openness ($\beta = .136$, $p = .010$), and resource supply ($\beta = .103$, $p = .028$); collegial support was non-significant ($\beta = .082$, $p = .133$). Both study hypotheses were supported.

Keywords: Innovation Climate, Teachers' Innovative Work Behavior, Secondary School, Qingdao, China

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INTRODUCTION

Curriculum documents can mandate many things. A better lesson is not among them, because a better lesson has to be invented by a teacher, argued for in a staff room, and then survived in front of thirty adolescents. International policy has begun to say this openly, casting teachers as agents of curriculum change instead of its recipients (OECD, 2025), and a conceptual review of teacher innovation places the same emphasis on what individual teachers deliberately do with new ideas (Liu et al., 2024). A systematic review of creative teaching in K-12 schools arrives at a similar position from the opposite direction, finding that the conditions surrounding a teacher weigh as heavily as the teacher's own disposition (Yang et al., 2025).

China has made the demand unusually explicit. Education Modernization 2035 wrote innovation into the system's guiding goals (Central Committee of the Communist Party of China & State Council, 2019), and the 2022 revision of the compulsory education curriculum standards asks secondary classrooms to build core competencies through inquiry and interdisciplinary work (Ministry of Education of the People's Republic of China, 2022). Studies of Chinese teachers read the Double Reduction reform in the same light, as a policy that withdrew the drilling which once absorbed the difference between good and ordinary teaching (Li & Zhu, 2022; Zhou et al., 2026). Secondary schools take the sharpest version of this pressure, since the teachers asked to innovate are the same teachers preparing students for the senior secondary and college entrance examinations, a tension recent Chinese evidence reports as unresolved (Wang, 2025).

Qingdao is a revealing place to ask the question. The city holds national experimental status for comprehensive basic education reform, completed a three-year programme to double high-quality educational resources, ran quality-improvement pilots in 53 junior secondary schools, and saw seven senior secondary schools enter the provincial characteristic-school category (Qingdao Municipal Education Bureau, 2025). Shandong province, in which the city sits, employed 315,600 full-time junior secondary teachers and 172,500 full-time teachers in regular senior secondary schools in 2024 (Shandong Provincial Department of Education, 2025). Reform ambition and a large teaching force therefore coexist here (Yang et al., 2025).

What the policies ask for costs the individual teacher something. Innovative work behavior sits outside the job description, consumes preparation time, and carries the risk of a lesson that visibly fails, so studies of educational innovation keep returning to risk and workload as the forces that hold teachers back (Sanchez & Gutierrez-Esteban, 2023; Kottmann et al., 2024). Evidence from 1,165 Chinese basic education teachers points the same way, with innovative teaching behavior rising and falling alongside the cognitive and energetic resources teachers can draw on (Li et al., 2025). Routine, by comparison, is quick and attracts no criticism. The interesting question is not why teachers stay with it, but what moves some of them away from it (Liu et al., 2024).

Among the candidate answers, the innovation climate of the school has the strongest claim on an administrator's attention. Teachers innovate more where they sense that new ideas are wanted, that experimenting is safe, and that someone will pay for what innovating costs (Scott & Bruce, 1994; Anderson & West, 1998), and the association has held in systems as different as Malaysia, Serbia, Oman, and China (Ninkovic et al., 2024; Alshuhumi et al., 2025; Mokhlis & Abdullah, 2025; Zhou et al., 2026).

Where inside the climate the association lives is far less clear. Most recent work enters climate as a single composite score and spends its statistical power on mediators such as self-efficacy, empowerment, or autonomy (Bao, 2024; Liu & Sun, 2025; Mokhlis & Abdullah, 2025). The resulting message, that climate matters, is accurate and of little practical use to a principal choosing between a budget line and a change in how failed lessons are received. The few studies that separated the parts found them behaving unlike one another: among 2,880 primary teachers in Chongqing, three of five climate dimensions related significantly to adaptive

instruction while two did not (Kouhsari, Huang, Wang, et al., 2024), and in Omani primary schools the direct association of climate with innovative practice shrank once teacher efficacy entered the same model (Alshuhumi et al., 2025). Composites conceal that pattern.

This study therefore examines innovation climate and teachers' innovative work behavior in the secondary schools of Qingdao, China, through a correlational survey. One research question guided the study: what is the relationship between innovation climate and teachers' innovative work behavior in secondary schools in Qingdao, China? The research objectives were (1) to study the level of innovation climate, (2) to study the level of teachers' innovative work behavior, and (3) to examine the relationship between the two. The hypotheses were that innovation climate is positively related to teachers' innovative work behavior (H1), and that at least three factors of innovation climate are positively related to teachers' innovative work behavior (H2). The scope of the study is the full-time teachers of regular junior secondary and senior secondary schools in Qingdao. For practice, the factor-level coefficients indicate which of the four conditions moves most closely with innovative work behavior; for research, the study contributes factor-level correlational evidence from Chinese secondary schools.

LITERATURE REVIEWS

Concepts and Theories Related to Innovation Climate

Scott and Bruce (1994) gave the construct its foundational form, describing the climate for innovation as members' perceptions of the extent to which the organization supports innovation and supplies the resources innovation requires. Two features of that formulation carried into everything after it: the climate lives in perceptions and not in documents, and it has both a normative face, signalling that new ideas are wanted, and a material one, indicating that new ideas will be paid for. Ekvall (1997) worked at a wider angle, treating the creative organizational climate as the recurring pattern of behaviors, attitudes, and feelings that characterizes life in an organization, expressed through conditions such as freedom, idea support, trust, debate, and risk taking. Anderson and West (1998) relocated the construct to the proximal work group, defining it through four shared perceptions: a clear and valued vision, participative safety, task orientation, and support for innovation. Amabile and Pratt (2016), revising the componential model of creativity and innovation, treated the work environment as three bundles: the organization's motivation to innovate, the resources available to it, and the practices of its managers.

Placed side by side, these accounts agree on a core and diverge on two points. The core is that innovation climate is a perception held by members about their own setting, with a normative face and a material one (AlEssa & Durugbo, 2022). The first divergence concerns the referent: Scott and Bruce (1994) ask individuals about the organization as they see it, which yields a psychological climate, while Anderson and West (1998) ask about the shared group and, in strict use, require agreement tests before responses are averaged. The second divergence concerns breadth, running from Ekvall's (1997) long inventory of conditions to a two-factor core. This study measures psychological climate because the research question concerns individual teachers, and retains four factors, wide enough to keep openness inside the construct and short enough for a usable instrument. A boundary separates the construct from its outcome: climate is a property teachers attribute to their school, whereas innovativeness is a disposition of the teacher, so the instrument phrases climate items about the school and behavior items about the respondent (Ozdemir & Cakalci, 2022; Yang et al., 2025).

Three lines of evidence explain why an intangible condition repays managerial attention. The first concerns reform: identical policy produces different classrooms depending on the school it reaches, and Chinese studies show school-level conditions activating teacher innovation even inside a centralized, examination-driven system (Wang, 2025; Zhou et al., 2026). The second concerns resources: among 4,594 Chinese primary teachers, school climate raised teacher

enthusiasm through collective and individual efficacy (Kouhsari, Huang, & Wang, 2024), while autonomy, the resource most obviously required for trying something untested, rises with a favourable climate (Lin, 2022). The third concerns manageability: curricula and examinations are set above the school, yet what leaders reward, how colleagues cooperate, what the school funds, and what may be proposed remain with the principal and the school's routines (Bao, 2024; Demir & Kalman, 2025).

Four factors carry the construct in this study, each corresponding to a condition a secondary school can change (Scott & Bruce, 1994; Anderson & West, 1998). Leadership support for innovation asks whether leaders encourage new teaching ideas, recognize the teachers who attempt them, back experimentation in practice, and respond to an unsuccessful lesson with understanding; in a system built on the principal responsibility system, those signals are among the loudest a Chinese teacher hears (Bao, 2024; Teng et al., 2024). Collegial support captures the willingness of colleagues to share, to assist, and to encourage; because Chinese secondary teachers plan, observe, and are evaluated inside subject-based teaching and research groups, colleagues form the nearest ring of the climate they perceive (Jang et al., 2024; Pan et al., 2024). Resource supply is the perceived adequacy of the personnel, funding, and time devoted to innovation, treated as a facet of climate and not a budget line, since what governs behavior is the belief that resources exist (Scott & Bruce, 1994; Amabile & Pratt, 2016). Encouragement of openness gathers the tolerance of reasonable risk and the openness of channels through which suggestions travel, the element Ekvall (1997) named risk taking and Anderson and West (1998) gathered into participative safety, and the element organizational research now calls psychological safety (You et al., 2022; Lecic et al., 2023).

Concepts and Theories Related to Teachers' Innovative Work Behavior

Scott and Bruce (1994) described individual innovative behavior as a multistage journey in which a problem is recognized, ideas are generated, sponsorship is sought, and a usable application results. Janssen (2000) produced the formulation the field still uses most, defining innovative work behavior as the intentional creation, introduction, and application of new ideas within a work role, group, or organization, for the benefit of role performance, the group, or the organization, and dividing it into idea generation, idea promotion, and idea realization. Later formulations expanded the sequence: Kleysen and Street (2001) distributed the construct across five activities, De Jong and Den Hartog (2010) made the noticing of opportunities explicit, and Messmann and Mulder (2012) treated teachers' innovative work behavior as a dynamic, context-bound sum of activities, with reflection on the innovation as an activity in its own right. Education-specific work has recently consolidated the construct: Liu et al. (2024) reviewed its conceptualizations and endorsed a reading, taken up by Chinese empirical work, of teacher innovation as the deliberate generation, implementation, modification, and dissemination of relatively novel instructional ideas intended to improve teaching effectiveness (Li et al., 2025).

Weighing these accounts together yields one convergence and one live fault line. The convergence is that innovative work behavior is behavior, not a trait or an attitude, its novelty must aim at usefulness, and it runs from conception through to embedded practice, which separates it from creativity alone (AlEssa & Durugbo, 2022; Liu et al., 2024). The fault line concerns the referent of measurement: some research measures the teacher's own acts, as Janssen-type items do, while other research measures perceptions of the collective by asking whether most teachers in the school develop new ideas (Zhou et al., 2026). This study asks about individual behavior and measures it with self-referenced items.

The construct earns its place through what lies downstream of it. Teachers' innovative behavior predicted students' academic self-efficacy and intrinsic goal orientation in secondary classrooms (Maun et al., 2023), and teachers' innovative behavior carried an innovative school climate into more demanding, technology-supported teaching in Serbia (Ninkovic et al., 2024).

Where educational innovation succeeds, it does so by stimulating this behavior in teachers and not by issuing instructions from above (Sanchez & Gutierrez-Esteban, 2023; Yang et al., 2025). Four stages carry the dependent variable here, following Janssen's (2000) sequence. Idea generation is the production of novel and useful ideas for teaching content, methods, activities, or persistent problems, including the exploration of opportunities that precedes them (Janssen, 2000; De Jong & Den Hartog, 2010). Idea promotion is the social stage of communicating a new teaching idea and mobilizing support, in which few classroom innovations advance far because Chinese secondary schools manage teaching collectively through subject groups, lesson plans, and evaluation (Jang et al., 2024; Liu & Sun, 2025). Idea realization converts intention into practice, the new activity actually run, revised after experience, and folded into regular teaching (Janssen, 2000; Messmann & Mulder, 2012). Idea evaluation appraises what implementation produced, and matters for teaching in particular, since a lesson innovation never judged against learning cannot be improved, retained on evidence, or abandoned on evidence (Messmann & Mulder, 2012; Lambriex-Schmitz et al., 2020).

Relationship Between Innovation Climate and Teachers' Innovative Work Behavior

Two theoretical accounts explain why the climate a teacher perceives and the innovating that teacher reports should move together. Social cognitive theory holds that environmental factors, personal factors, and behavior operate reciprocally, so the conditions surrounding a teacher shape the behavior that teacher produces (Bandura, 1986). The componential account is more specific about the route, holding that the work environment reaches individual innovation through the organization's motivation to innovate, the resources it makes available, and the practices of its managers (Amabile & Pratt, 2016). Both converge on one mechanism: a supportive, resourced, open climate signals that innovation is wanted, lowers its cost, and softens the penalty for honest failure, so teachers who perceive more of it should report more innovative work behavior (Scott & Bruce, 1994; AlEssa & Durugbo, 2022).

Evidence for the association is broad. School innovation climate carried principal inclusive leadership into teacher innovative behavior among 358 primary and junior secondary teachers in Guangdong (Bao, 2024). Among 376 teachers in Malaysian public schools, innovation climate predicted innovative work behavior with self-efficacy as a partial mediator (Mokhlis & Abdullah, 2025). In the largest of the recent Chinese analyses, school climate predicted the innovation of 3,976 Shanghai secondary teachers, with a substantial direct effect surviving its mediators (Zhou et al., 2026). Organizational climate related to teaching innovation both directly and through teaching efficacy among 2,092 Chinese preschool teachers (Zhang et al., 2024). Where climate has been disaggregated, however, the parts diverge: among 2,880 primary teachers in Chongqing, three of five climate dimensions related significantly to adaptive instruction while two did not (Kouhsari, Huang, Wang, et al., 2024), and in Omani primary schools the direct association of climate with innovative practice was modest once teacher self-efficacy stood in the same model (Alshuhumi et al., 2025).

The mechanisms attach to particular factors and not to the construct in general. Outcome expectation links leadership support and openness to behavior, since what leaders reward and what the school permits define the expected payoff of innovating (Bandura, 1986; Lecic et al., 2023). Vicarious learning and social reinforcement link collegial support, because colleagues model the behavior and supply the first allies for a new idea (Jang et al., 2024; Pan et al., 2024). Enabling conditions link resource supply, since intentions become acts only where time, materials, and training exist (Amabile & Pratt, 2016; Li et al., 2025). Accordingly, two hypotheses were derived. H1: Innovation climate is positively related to teachers' innovative work behavior in secondary schools in Qingdao, China. H2: At least three factors of innovation climate are positively related to teachers' innovative work behavior in secondary schools in Qingdao, China.

Figure 1 shows the conceptual framework of the study, in which innovation climate is the independent variable in four factors and teachers' innovative work behavior is the dependent variable in four stages; because the design is correlational, the arrow shows the direction of the hypothesized association and not a demonstrated causal path.

H1: Innovation climate is positively related to teachers' innovative work behavior in secondary schools in Qingdao, China.

H2: At least three factors of innovation climate are positively related to teachers' innovative work behavior in secondary schools in Qingdao, China.

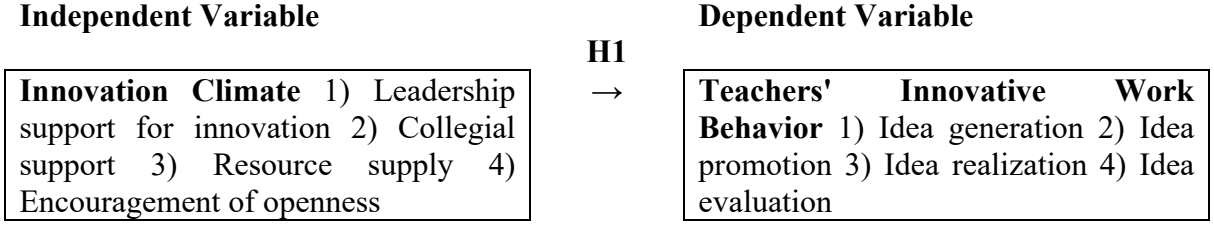

Figure 1 Conceptual Framework Adapted from Scott & Bruce (1994), Anderson & West (1998), Bandura (1986), and Janssen (2000).

RESEARCH METHODOLOGY

This study adopted a cross-sectional correlational survey quantitative design. All variables were measured at one time point from the same group of individual-teacher respondents without variable manipulation, so results reflect associations rather than causal relationships, following the psychological-climate perspective that innovation climate represents individual teachers' perceptions of school conditions instead of aggregated school-level properties. The target population consisted of full-time teachers from regular junior and senior secondary schools in Qingdao, excluding secondary vocational schools. Based on Krejcie and Morgan (1970) sample-size criteria, 400 valid questionnaires were collected (200 for each school stage) using non-probability quota sampling via online school-channel distribution, given the absence of a public teacher roster (Qingdao Municipal Education Bureau, 2025; Li et al., 2025; Mokhlis & Abdullah, 2025). The 39-item structured questionnaire contained three parts: demographic items, a 16-item innovation-climate scale adapted from Scott and Bruce (1994) and Anderson and West (1998), and a 16-item teachers' innovative-work-behavior scale adapted from Janssen (2000), De Jong and Den Hartog (2010), and Messmann and Mulder (2012). All scale items used a five-point Likert format without reverse-worded items (Podsakoff et al., 2003); bilingual translation and back-translation procedures guaranteed instrument validity (Brislin, 1970), and Cronbach's alpha $\geq .70$ was the reliability threshold (Hinkle et al., 2003). Data were gathered electronically via the Wenjuanxing platform from 1 October to 30 October 2026 with anonymous voluntary participation, and low-quality responses were filtered prior to analysis. Descriptive statistics (frequencies, percentages, means, standard deviations) described participant profiles and variable levels, while Pearson product-moment correlation coefficients at the .05 significance level tested H1. Multiple regression with the enter method was used to test H2, entering all four innovation-climate factors simultaneously as predictors of teachers' innovative work behavior, holding other factors constant. Normality, linearity and outliers were checked beforehand and coefficient magnitudes interpreted following Hinkle et al. (2003).

RESEARCH RESULTS

The independent study obtained data from 400 teachers in regular junior secondary and regular senior secondary schools in Qingdao. Between 1 October 2026 and 30 October 2026, four hundred questionnaires were distributed via the Wenjuanxing platform and four hundred were returned, a 100.00 percent return rate. All returned questionnaires met the three screening

criteria, so all four hundred were included in the analysis, two hundred from each school stage. Data analysis was conducted using jamovi.

Respondents' Profiles

Table 1 summarizes the respondents' general information. Most respondents were female (230, 57.50%), and the largest age group was 26-35 years (146, 36.50%), followed by 36-45 years (139, 34.75%). Most held a bachelor's degree (264, 66.00%), and the largest group had taught for 11 to 20 years (145, 36.25%). The proportion holding first-level teacher titles was the highest (159, 39.75%), and the sample comprised junior and senior secondary teachers in equal numbers (200 each, 50.00%). Humanities and science subjects together accounted for more than two-fifths of the respondents.

Table 1 Frequency and Percentage of Respondents' General Information

General Information	Frequency	Percentage
Gender - Female	230	57.50
Gender - Male	170	42.50
Age 26-35 years	146	36.50
Age 36-45 years	139	34.75
Bachelor's degree	264	66.00
Teaching experience 11-20 years	145	36.25
First-level teacher title	159	39.75
Junior secondary school	200	50.00
Senior secondary school	200	50.00
Total	400	100.00

Levels of Innovation Climate

Table 2 presents the mean and standard deviation of innovation climate and its four factors. The findings revealed that most respondents had an overall high opinion of the innovation climate (M = 3.70, SD = 0.52). The responses ranked highest for collegial support (M = 3.79, SD = 0.63), followed by resource supply (M = 3.72, SD = 0.66) and leadership support for innovation (M = 3.70, SD = 0.66), while the lowest response was for encouragement of openness (M = 3.60, SD = 0.69). Although all four scores lie within the high range, the discrepancy of 0.19 points indicates that they are not uniformly distributed among the schools.

Table 2 Mean and Standard Deviation of Innovation Climate

Innovation Climate / Factor	M	SD	Level
Leadership support for innovation	3.70	0.66	High
Collegial support	3.79	0.63	High
Resource supply	3.72	0.66	High
Encouragement of openness	3.60	0.69	High
Total innovation climate	3.70	0.52	High

Within encouragement of openness, the only statement rated moderately in the whole questionnaire was 'In this school, taking reasonable risks in order to improve teaching is tolerated' (M = 3.35, SD = 0.95); within collegial support, the highest-rated statement was 'When I try something new in my teaching, my colleagues give me encouragement and support' (M = 3.97), and the lowest was 'My colleagues willingly share new teaching ideas and experience with one another' (M = 3.53). Within resource supply, 'Teachers in this school can obtain time to develop new teaching ideas' scored highest (M = 3.86) and 'The conditions and equipment of the school support the use of new teaching methods and technologies' lowest (M = 3.59). Within leadership support, 'School leaders encourage teachers to try new teaching

methods' scored highest (M = 3.94) and 'School leaders take the new teaching ideas proposed by teachers seriously' lowest (M = 3.58).

Levels of Teachers' Innovative Work Behavior

Table 3 shows that most respondents felt highly positive about teachers' innovative work behavior (M = 3.78, SD = 0.45). Among the four components, idea generation was reported most often (M = 3.85, SD = 0.61), followed by idea realization (M = 3.76, SD = 0.60) and idea evaluation (M = 3.75, SD = 0.61), with idea promotion reported least often (M = 3.74, SD = 0.60). The four components are arranged according to how theory would predict: teachers are more likely to generate ideas than to execute the social labor of persuading their peers and superiors.

Table 3 Mean and Standard Deviation of Teachers' Innovative Work Behavior

Teachers' Innovative Work Behavior / Component	M	SD	Level
Idea generation	3.85	0.61	High
Idea promotion	3.74	0.60	High
Idea realization	3.76	0.60	High
Idea evaluation	3.75	0.61	High
Total innovative work behavior	3.78	0.45	High

Reliability and Hypothesis Testing

Prior to hypothesis testing, the reliability of the two measures was assessed. Table 4 shows that all subscales achieved a Cronbach alpha coefficient above the .70 cutoff (range α = .799-.866). The innovation climate scale comprising sixteen items had a Cronbach alpha of .911 (excellent), while the teachers' innovative work behavior scale comprising sixteen items had a Cronbach alpha of .877 (good). Both scales therefore achieved good internal consistency, and no further modification of the data was necessary.

Table 4 Reliability of the Research Instrument

Scale	Items	Cronbach's α	Interpretation
Leadership support for innovation	4	.866	Good
Collegial support	4	.849	Good
Resource supply	4	.844	Good
Encouragement of openness	4	.818	Good
Innovation climate (total)	16	.911	Excellent
Idea generation	4	.814	Good
Idea promotion	4	.810	Good
Idea realization	4	.799	Acceptable
Idea evaluation	4	.811	Good
Teachers' innovative work behavior (total)	16	.877	Good

Prior to interpreting the Pearson coefficients, the assumptions of the test were checked. The skewness values ranged from -0.243 to -0.074 and the kurtosis values from -0.485 to -0.110, within the acceptable limits of ±1.00, so the data were normally distributed. The linearity assumption was assessed by inspection of the scatterplots, which showed linear and not curvilinear relationships. As a check, the Spearman rank-order coefficient between the two variables (ρ = .576) and those between the four factors and innovative work behavior (ρ = .559, .448, .429, and .357) did not differ from the Pearson coefficients by more than 0.016, and the relative rank order was unchanged; therefore the Pearson coefficients were presented.

Hypothesis 1 stated that innovation climate is positively related to teachers' innovative work behavior. Table 5 shows that the two variables were positively and significantly correlated (r

= .580, p < .001). According to the criteria of Hinkle et al. (2003), the magnitude was moderate, and the coefficient of determination was 33.59 percent. Hypothesis 1 was therefore supported: schools in which teachers perceived a higher level of innovation climate tended to have teachers who reported a higher level of innovative work behavior.

Table 5 Correlation Between Innovation Climate and Teachers' Innovative Work Behavior

Variable	Innovation Climate	Teachers' IWB
Innovation climate (r)	-	.580
df	-	398
p-value	-	< .001

Hypothesis 2 stated that at least three factors of innovation climate are positively related to teachers' innovative work behavior. Table 6 shows that all four factors were positively and significantly related to teachers' innovative work behavior at the .05 level. Leadership support for innovation yielded the highest coefficient (r = .571, p < .001), followed by encouragement of openness (r = .451, p < .001), collegial support (r = .444, p < .001), and resource supply (r = .373, p < .001). The requirement for Hypothesis 2 was that at least three factors be positively related to the dependent variable; four were, so Hypothesis 2 was supported. Because the four factors are also related to each other (correlations ranging from .375 to .634), the order of the coefficients represents the strength of each factor taken alone, not the unique contribution of each factor after controlling for the other three.

Table 6 Correlation Between the Four Factors of Innovation Climate and Teachers' Innovative Work Behavior

Factor of Innovation Climate	r	df	p
Leadership support for innovation	.571	398	< .001
Encouragement of openness	.451	398	< .001
Collegial support	.444	398	< .001
Resource supply	.373	398	< .001

The coefficients in Table 6 treat each factor on its own, and the four factors are themselves related, so each of those coefficients carries variance that the factor shares with the other three. Multiple regression was therefore used to test Hypothesis 2, with the four factors of innovation climate entered simultaneously as predictors of teachers' innovative work behavior by the enter method, so that each coefficient reports the contribution of one factor while the other three are held constant. Table 4.16 shows the fit of the model.

Table 4.16 *Model fit measures of the multiple regression*

Model	R	R^2	Adjusted R^2	SE of the estimate	Durbin-Watson
1	.598	.358	.351	0.364	2.104

Note. N = 400. Predictors: leadership support for innovation, collegial support, resource supply, encouragement of openness. Dependent variable: teachers' innovative work behavior.

From Table 4.16, it was found that the four factors of innovation climate together accounted for 35.76% of the variance in teachers' innovative work behavior (R^2 = .358), and 35.11% after adjustment for the number of predictors (adjusted R^2 = .351). The multiple correlation of .598 is marginally higher than the correlation of .580 obtained for the total climate score in Table 5, which indicates that separating the climate into four factors adds little predictive power beyond the composite. The Durbin-Watson statistic of 2.104 lies inside the range of 1.5 to 2.5

conventionally taken to indicate independent residuals. Table 4.17 shows the omnibus test of the model.

Table 4.17 *Omnibus ANOVA test of the regression model*

Source	Sum of squares	df	Mean square	F	p
Regression	29.097	4	7.274	54.970	< .001
Residual	52.272	395	0.132		
Total	81.369	399			

Note. N = 400.

From Table 4.17, it was found that the regression model was statistically significant, $F(4, 395) = 54.970$, $p < .001$. The four factors of innovation climate taken together therefore predict teachers' innovative work behavior at the .05 level. Table 4.18 shows the contribution of each factor.

Table 4.18 *Regression coefficients of the four factors of innovation climate*

Predictor	B	SE	β	t	p	Tolerance	VIF
(Constant)	1.986	0.132		14.994	< .001		
Leadership Support for Innovation	0.265	0.040	.388	6.605	< .001	0.471	2.12
Encouragement of Openness	0.089	0.034	.136	2.602	.010	0.598	1.67
Resource Supply	0.071	0.032	.103	2.210	.028	0.744	1.34
Collegial Support	0.059	0.039	.082	1.507	.133	0.550	1.82

Note. N = 400. Dependent variable: teachers' innovative work behavior. β = standardised coefficient.

From Table 4.18, it was found that three of the four factors made a statistically significant positive contribution with the other three factors held constant. Leadership Support for Innovation was much the strongest ($\beta = .388$, $t = 6.605$, $p < .001$), followed by encouragement of openness ($\beta = .136$, $t = 2.602$, $p = .010$) and resource supply ($\beta = .103$, $t = 2.210$, $p = .028$). Collegial Support did not reach significance ($\beta = .082$, $t = 1.507$, $p = .133$), although its zero-order correlation with the dependent variable was positive and significant ($r = .444$) in Table 6. The requirement stated in Hypothesis 2 was that at least three factors be positively related to the dependent variable, and three were. Hypothesis 2 was therefore supported.

The collinearity statistics in Table 4.18 show tolerance values between 0.471 and 0.744 and variance inflation factors between 1.34 and 2.12, all well inside the usual limits of tolerance above .20 and VIF below 5. The overlap among the four factors is therefore not large enough to destabilise the coefficients, and the fall of collegial support to non-significance reflects the variance it shares with leadership support for innovation, with which it correlates .634, and not an estimation problem.

The standardised residuals lie along the diagonal of the normal probability plot throughout its length, and the residual plot shows the points spread evenly above and below zero across the whole range of predicted values, in a horizontal band with no funnel and no curvature, so the variance of the residuals is constant. The assumptions of linearity, normality, homoscedasticity, independence and limited collinearity are therefore all met, and the coefficients in Table 4.18 can be read as they stand.

4.5 Summary of the data analysis results

Table 4.19 shows a summary of the hypothesis testing results.

Table 4.19 *Summary of the hypothesis testing results*

Hypothesis	Statistic	Value	Test result
H1: Innovation climate is positively related to teachers' innovative work behavior	*r*	.580***	Supported
H2: At least three factors of innovation climate are positively related to teachers' innovative work behavior			Supported
- Leadership Support for Innovation	β	.388***	Supported
- Encouragement of Openness	β	.136**	Supported
- Resource Supply	β	.103*	Supported
- Collegial Support	β	.082	Not supported

*** Statistical significance at the .001 level, ** at the .01 level, * at the .05 level

DISCUSSION & CONCLUSION

This study examined the relationship between teachers' perception of innovation climate and their innovative work behavior in secondary schools in Qingdao. The innovation climate was at a high level (M = 3.70, SD = 0.52), though not high across the board, with collegial support highest and encouragement of openness lowest, and only one statement—tolerance for reasonable risk (M = 3.35)—rated moderately. Innovative work behavior was also at a high level (M = 3.78, SD = 0.45), with idea generation highest and idea promotion lowest. The two variables were positively and significantly correlated at a moderate strength ($r = .580$, $p < .001$), with 33.59 percent of common variance, all four factors showed significant zero-order correlations with innovative work behavior, yet only three factors demonstrated significant unique predictive effects in multiple regression. Collegial support became non-significant after controlling for the other three factors. Both hypotheses were confirmed.

The moderate coefficient is precisely what one would expect in a mediated model. Mokhlis and Abdullah (2025) inserted self-efficacy as the mediator between climate and behavior, and Zhou et al. (2026) did the same with a chain comprising teacher autonomy and self-efficacy; in both cases, the direct effect diminished when the mediator was included. In Bandura's (1986) social cognitive theory, an organization that encourages innovation does not influence behavior directly, but provides the mastery experiences, models, and verbal persuasion that teachers use to construct a sense of their own capabilities, and it is the latter that translates into behavior. The unexplained 66.41 percent of variance also carries meaning: teachers themselves are as important as the conditions they find themselves in, since emotional competence, burnout, irrational beliefs, and teacher-student relationships all independently predict innovative behavior (Gkontelos et al., 2023; Li et al., 2025; Wang, 2025), and the examination system of Qingdao operates against the climate (Yang et al., 2025). The study is correlational, so the direction of the association is not established; a reciprocal reading, in which teachers who already innovate rate their school climate more positively, is equally consistent with the data (Lecic et al., 2023).

Among the four factors, leadership support for innovation showed the strongest relationship with innovative work behavior ($r = .571$) even though it did not obtain the highest mean (M = 3.70, third of four). The discrepancy between the two rankings is the key result of the study: what teachers have the most of is not what influences them the most. The distribution of items within the factor is more telling: encouragement to try new methods (3.94) scored highest while taking proposed ideas seriously (3.58) scored lowest, and the distance between them represents the space between encouraging innovation and actually facilitating it. This is consistent with the recent literature, in which inclusive leadership that supports the implementation of an idea predicts creative instruction better than mere encouragement (Nguyen et al., 2022). Encouragement of openness recorded the lowest mean (3.60) yet the second strongest correlation ($r = .451$), pointing to a scarcity effect: it is the least common feature of these

schools and one of the most important, and the only factor that can most easily be improved without a budget, by a decision about how experimental lessons count (Ekvall, 1997; Ozdemir & Cakalci, 2022). Collegial support scored highest in mean (3.79) but third in correlation (r = .444), because collaboration inside subject groups is almost invariant, and invariance cannot predict variability (Jang et al., 2024; Pan et al., 2024). Resource supply had the lowest correlation (r = .373) but the second highest mean (3.72), consistent with a threshold effect in a sub-provincial city whose per-student expenditure far exceeds the national average: once provision no longer limits performance, extra provision stops distinguishing people (Qingdao Municipal Education Bureau, 2025).

The implications follow from these findings. Leadership support is where the greatest opportunity for improvement remains: schools should establish a defined process by which a teacher may submit a proposal, receive a decision and explanation, and receive specific time or funding if approved. Encouragement of openness requires no funding, only a change in how achievement is measured, such as allocating part of the curriculum as a sandbox where results are evaluated for insights but not compared to other classes. Collegial support needs a mechanism to circulate genuinely novel techniques, since teachers' research groups already convene. Resource supply argues against further expenditure on equipment and in favor of time off, small project-linked awards, and aligned training. Finally, idea promotion was the lowest component of innovative work behavior (M = 3.74), with making influential members of the school keen on an idea lowest within it (M = 3.54) compared with getting support from colleagues (M = 4.09): teachers can persuade their fellow-teachers but not the administrators, so ideas generated at a high level will not move forward without a clear channel to the administration.

This study has limitations that qualify its conclusions. The cross-sectional, single-source design precludes causal inference and cannot rule out common method variance (Podsakoff et al., 2003); the psychological-climate measurement cannot show how far climate perceptions are shared within any one school, a question that would require many respondents per school and multilevel analysis (Bao, 2024); and quota sampling does not support statistical generalization to all secondary teachers in Qingdao. Future research should employ a longitudinal or cross-lagged panel study measuring both variables at two or more times in the same schools; collect data at the school level with multilevel models; include individual variables such as efficacy, burnout, and workload alongside the climate factors; and extend the design to lower-affluence settings where the resource factor is not saturated.

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