



A Structural Equation Model of Servant Leadership and Innovative Behavior: The Mediating Role of Job Engagement

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ABSTRACT

This study aimed to develop and validate a mediating model explaining the relationship between servant leadership and innovative behavior, with job engagement as a mediator among educational personnel in higher vocational and technical colleges in Guangzhou, Guangdong Province, China. A total of 310 respondents were selected using a stratified random sampling technique. Data were collected through a structured questionnaire using a five-point Likert scale. Confirmatory Factor Analysis (CFA) was employed to assess construct validity and reliability, while Structural Equation Modeling (SEM) was used to test the hypothesized relationships and mediating effects. The results indicated that servant leadership did not have a significant direct effect on innovative behavior ($\beta = 0.123$, $p > .05$). However, servant leadership had a significant positive effect on job engagement ($\beta = 0.080$, $p < .001$), and job engagement significantly influenced innovative behavior ($\beta = 0.131$, $p < .001$). Furthermore, the indirect effect of servant leadership on innovative behavior through job engagement was statistically significant ($\beta = 0.113$, $p < .001$), indicating a full mediation effect. The structural model demonstrated a good fit with the empirical data. The findings provide important theoretical implications by supporting the mediating role of job engagement within the Job Demands–Resources (JD-R) model, explaining how servant leadership indirectly enhances innovative behavior. This study contributes to the literature by addressing empirical inconsistencies regarding the direct and indirect effects of servant leadership and extending the application of the JD-R model in the context of vocational education.

KEYWORDS: Servant Leadership, Job Engagement, Innovative Behavior, Vocational Education, Guangzhou



Introduction

Guangzhou, a core metropolis within the Guangdong–Hong Kong–Macao Greater Bay Area, plays a pivotal role in China’s strategy of innovation-driven development and industrial upgrading (Xiao et al., 2025). As the regional economy increasingly shifts toward advanced manufacturing, digital industries, and modern service sectors, higher vocational and technical colleges have become key institutions for cultivating skilled human capital capable of responding to rapid technological and organizational change (Geng & Wang, 2024). In this context, the innovative capacity of educational personnel including teachers, academic staff, and administrators has become a critical determinant of institutional effectiveness and the quality of vocational education.

Despite their strategic importance, many higher vocational and technical colleges continue to face challenges in organizational management and human resource development. Educational personnel often encounter heavy workloads, administrative pressures, and rigid bureaucratic structures, which may weaken job engagement and constrain their willingness to engage in innovative practices such as adopting new teaching methods, redesigning curricula, and initiating institutional improvements (Ghlichlee & Motaghed Larijani, 2024). Prior research suggests that innovative behavior is not solely dependent on individual capability but is significantly shaped by leadership styles and organizational context (Ren & Shen, 2024).

Servant leadership has emerged as a people-centered leadership approach that emphasizes service, empowerment, ethical behavior, and the development of followers’ potential. This leadership style positions leaders as facilitators who enhance employees’ psychological well-being, professional growth, and sense of meaningful work (Shaojin et al., 2025). In educational settings, servant leadership has been associated with positive outcomes such as trust, job satisfaction, and organizational commitment (Zeng et al., 2022), all of which are essential for fostering innovation in complex and collaborative environments like vocational colleges.

However, the existing literature reveals several important research gaps. First, an empirical gap exists due to inconsistent findings regarding the relationship between servant leadership and innovative behavior. While some studies report a significant direct effect, others suggest that the relationship is indirect and operates through mediating variables such as psychological states or organizational mechanisms (Iqbal et al., 2023). This inconsistency indicates that the underlying process linking leadership and innovation is not yet fully understood.

Second, a theoretical gap remains in explaining how servant leadership influences innovative behavior. Much of the prior research relies on a single theoretical perspective, such as Social Exchange Theory, without integrating broader frameworks. The Job Demands–Resources (JD-R) model, which explains how job resources enhance employee engagement and

performance, offers a more comprehensive explanation but has not been sufficiently applied in this research stream. In particular, the mediating role of job engagement as a key motivational mechanism requires further theoretical and empirical clarification.

Third, a contextual gap is evident in the limited focus on higher vocational and technical education. Most existing studies have been conducted in corporate settings or general education contexts, with relatively little attention given to vocational colleges, which operate under distinct institutional conditions characterized by close industry collaboration, practice-oriented curricula, and regionally driven development goals (Alajhar & Salam, 2022). This limits the generalizability of existing findings to vocational education systems, especially in rapidly developing urban regions such as Guangzhou.

Given these gaps, this study aims to develop and empirically test a mediating model explaining how servant leadership influences the innovative behavior of educational personnel through job engagement in higher vocational and technical colleges in Guangzhou, Guangdong Province, China. By employing Structural Equation Modeling (SEM), this study examines both direct and indirect relationships among the variables. The findings are expected to contribute to the literature by addressing empirical inconsistencies, extending the application of the JD-R model, and providing context-specific insights for vocational education institutions. Furthermore, the study offers practical implications for leadership development, human resource management, and innovation promotion in educational organizations operating in dynamic and innovation-driven environments.

Research Objectives

1. To develop and validate a structural model examining the relationships among servant leadership, job engagement, and innovative behavior among educational personnel in higher vocational and technical colleges in Guangzhou, China.
2. To examine the direct effect of servant leadership on innovative behavior.
3. To investigate the effect of servant leadership on job engagement.
4. To examine the effect of job engagement on innovative behavior.
5. To test the mediating role of job engagement in the relationship between servant leadership and innovative behavior.

Research Hypothesis

H1: Servant leadership has a significant direct effect on innovative behavior among educational personnel.

H2: Servant leadership has a significant positive effect on job engagement.



H3: Job engagement has a significant positive effect on innovative behavior.

H4: Job engagement mediates the relationship between servant leadership and innovative behavior.

Scope of Research

This study focuses on examining the relationships among servant leadership, job engagement, and innovative behavior within higher vocational and technical colleges in Guangzhou, Guangdong Province, China.

The scope of the study is defined as follows:

Population and Sample: Educational personnel, including teachers, academic staff, and administrators in higher vocational and technical colleges in Guangzhou.

Variables:

Independent Variable: Servant Leadership

Mediating Variable: Job Engagement

Dependent Variable: Innovative Behavior

Content Scope: The study examines leadership practices, employee psychological engagement, and innovative work behavior within educational organizations.

Analytical Approach: Structural Equation Modeling (SEM) is employed to analyze both direct and indirect relationships among the variables.

Research methods

This study employed a quantitative research design using a cross-sectional survey approach to examine the relationships among servant leadership, job engagement, and innovative behavior among educational personnel in higher vocational and technical colleges in Guangzhou, Guangdong Province, China. Structural Equation Modeling (SEM) was utilized as the primary analytical technique to test both direct and indirect relationships among latent variables. This approach is appropriate for analyzing complex relationships and mediating effects in organizational and educational research.

The population consisted of educational personnel, including teachers, academic staff, and administrators working in higher vocational and technical colleges in Guangzhou. A stratified random sampling technique was employed to ensure adequate representation across institutions, departments, and professional roles.

The sample size was determined based on SEM requirements and statistical power considerations. Although a minimum sample size of 200 is generally recommended for SEM

analysis, this study employed a sample of 310 respondents ($n = 310$) to enhance statistical power, improve estimation accuracy, and increase the generalizability of the findings.

Data were collected using a structured questionnaire with a five-point Likert scale measuring servant leadership, job engagement, and innovative behavior. The measurement instruments were adapted from established scales in prior studies, and content validity was assessed by experts. Reliability was evaluated using Cronbach's alpha and Composite Reliability (CR), while construct validity was assessed through Confirmatory Factor Analysis (CFA), including convergent validity (AVE) and discriminant validity (e.g., Fornell–Larcker criterion or HTMT ratio).

To address potential common method bias (CMB), Harman's single-factor test was conducted. Additionally, bootstrapping procedures (e.g., 5,000 resamples) were applied in SEM to examine the significance of indirect effects and mediation. Model fit was evaluated using multiple fit indices, including χ^2 / df , CFI, TLI, RMSEA, and SRMR, following established thresholds.

Conceptual Framework

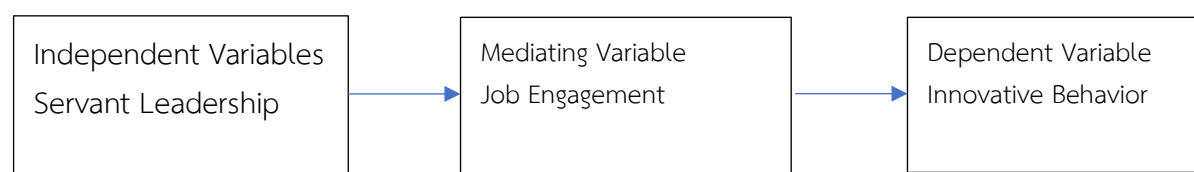


Illustration 1 Research framework

Research Instruments

The research instrument was a structured questionnaire consisting of four sections:
Demographic information (e.g., gender, age, education level, work experience, and position)
Servant leadership scale
Job engagement scale
Innovative behavior scale

All measurement items were adapted from established and validated scales in prior studies and modified to suit the vocational education context. Responses were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Content validity was assessed by a panel of experts in educational leadership and organizational behavior. A pilot study was conducted to evaluate the clarity and reliability of the instrument, and necessary revisions were made accordingly. Reliability was confirmed using Cronbach's alpha coefficient (≥ 0.70). In addition, Composite Reliability (CR) and Average Variance Extracted (AVE) were examined to ensure construct reliability and convergent validity.



Revised Data Collection

Data Collection

Data were collected from selected respondents using both online and paper-based questionnaires. Participation was voluntary, and informed consent was obtained from all participants prior to data collection.

Ethical considerations were strictly observed, including ensuring confidentiality and anonymity of respondents. Participants were informed of the purpose of the study and their right to withdraw at any time without penalty.

Revised Data Analysis

Data Analysis

Descriptive statistics were used to analyze demographic characteristics and the distribution of the data.

Confirmatory Factor Analysis (CFA) was conducted to assess the measurement model, including construct validity (convergent and discriminant validity) and reliability. Convergent validity was evaluated using factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE), while discriminant validity was assessed using the Fornell–Larcker criterion or the Heterotrait–Monotrait (HTMT) ratio.

Structural Equation Modeling (SEM) was employed to test the hypothesized relationships among variables, including both direct and indirect effects. Model fit was evaluated using multiple fit indices, including Chi-square (χ^2), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), based on established threshold criteria.

The significance of direct and indirect effects was examined using standardized path coefficients (β) and bootstrapping procedures (e.g., 5,000 resamples) to test the mediating effect of job engagement.

Specifically, the analysis aimed to:

Examine the effect of servant leadership on job engagement

Examine the effect of job engagement on innovative behavior

Examine the direct effect of servant leadership on innovative behavior

Test the mediating effect of job engagement

Research Results

1. Demographic Characteristics of the Sample

The sample consisted of 310 educational personnel from higher vocational and technical colleges in Guangzhou. Among the respondents, 34.84% were male and 65.16% were female.

The majority were aged 31–40 years (42.26%), followed by 41–50 years (23.87%), above 50 years (17.42%), and 20–30 years (16.45%).

In terms of educational background, most respondents held a master's degree (68.39%), followed by bachelor's (22.90%) and doctoral degrees (8.71%). Regarding work experience, 27.10% had more than 20 years of experience, while the remaining respondents were relatively evenly distributed across other experience levels. These characteristics indicate that the sample adequately represents diverse educational personnel in vocational institutions.

2. Measurement Model (CFA Results)

Confirmatory Factor Analysis (CFA) was conducted to assess the validity and reliability of the measurement model. The standardized factor loadings ranged from 0.657 to 0.887 and were all statistically significant ($p < .001$), indicating strong convergent validity.

Composite Reliability (CR) values ranged from 0.778 to 0.867, exceeding the recommended threshold of 0.70. Average Variance Extracted (AVE) values ranged from 0.501 to 0.685, exceeding the acceptable level of 0.50. These results confirm satisfactory internal consistency and convergent validity.

The model fit indices indicated an excellent fit to the data ($\chi^2 / df = 1.14$, CFI=0.996, TLI=0.995, RMSEA=0.022, SRMR=0.008), supporting the adequacy of the measurement model.

3. Structural Model and Model Fit

Structural Equation Modeling (SEM) was employed to test the hypothesized relationships. The structural model demonstrated an excellent fit with the empirical data ($\chi^2 / df = 1.14$, CFI=0.996, TLI=0.995, RMSEA=0.022, SRMR=0.008), indicating that the proposed model was appropriate for explaining the relationships among the constructs.

4. Hypothesis Testing

The results of hypothesis testing are summarized as follows:

H1: Servant leadership $\rightarrow$ Innovative behavior

The direct effect was not statistically significant ($\beta = 0.123$, $p > .05$). Thus, H1 was not supported.

H2: Servant leadership $\rightarrow$ Job engagement

Servant leadership had a significant positive effect on job engagement ($\beta = 0.080$, $p < .001$). Thus, H2 was supported.

H3: Job engagement $\rightarrow$ Innovative behavior

Job engagement had a significant positive effect on innovative behavior ($\beta = 0.131$, $p < .001$). Thus, H3 was supported.

H4: Indirect effect (mediation)



The indirect effect of servant leadership on innovative behavior through job engagement was statistically significant ($\beta=0.113$, $p<.001$), confirming the mediating role of job engagement.

5. Summary of Findings

The findings indicate that servant leadership does not directly influence innovative behavior. However, it significantly enhances job engagement, which in turn positively affects innovative behavior. The significant indirect effect suggests that job engagement fully mediates the relationship between servant leadership and innovative behavior.

These results highlight that leadership practices contribute to innovation primarily through enhancing employees' psychological engagement rather than through direct influence.

Table 1 Model Fit Indices of the Structural Equation Model

Fit Index	Acceptable Criteria	Obtained Value	Interpretation
χ^2 / df	<3.00	1.14	Good fit
GFI	≥ 0.90	0.974	Excellent fit
AGFI	≥ 0.90	0.958	Excellent fit
CFI	≥ 0.95	0.996	Excellent fit
TLI	≥ 0.95	0.995	Excellent fit
RMR	≤ 0.05	0.008	Excellent fit
RMSEA	≤ 0.08	0.022	Excellent fit

Note. $\chi^2=46.869$, $df=41$, $p=.244$.

GFI=Goodness-of-Fit Index; AGFI=Adjusted Goodness-of-Fit Index;

CFI=Comparative Fit Index; TLI=Tucker-Lewis Index;

RMR=Root Mean Square Residual; RMSEA=Root Mean Square Error of Approximation.

Table 2 Standardized Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	β (Standardized)	Z-value	p-value	Result
H1	Servant Leadership $\rightarrow$ Innovative Behavior	0.123	0.505	.613	Not Supported
H2	Servant Leadership $\rightarrow$ Job Engagement	0.080	9.910	<.001	Supported
H3	Job Engagement $\rightarrow$ Innovative Behavior	0.131	6.831	<.001	Supported

(continued)

Table 2 (continued)

Hypothesis	Path	β (Standardized)	Z-value	p-value	Result
H4	Servant Leadership $\rightarrow$ Job Engagement $\rightarrow$ Innovative Behavior (Indirect)	0.113	5.820	<.001	Supported

Note. β =standardized path coefficient.

Indirect effects were tested using bootstrapping procedures.

Table 3 Reliability and Validity of Latent Constructs

Construct	CR	AVE	Interpretation
Servant Leadership	0.834	0.501	Acceptable reliability
Job Engagement	0.778	0.540	Acceptable reliability
Innovative Behavior	0.867	0.685	Good reliability

Note. CR=Composite Reliability; AVE=Average Variance Extracted.

CR $\geq$ 0.70 and AVE $\geq$ 0.50 indicate acceptable reliability and convergent validity.

Table 4 Confirmatory Factor Analysis (CFA): Standardized Factor Loadings, Composite Reliability (CR), and Average Variance Extracted (AVE)

Construct	Indicator	Standardized Loading (λ)	CR	AVE
Servant Leadership	SL1	0.657	0.834	0.501
	SL2	0.712		
	SL3	0.785		
	SL4	0.843		
	SL5	0.887		
Job Engagement	TJE1	0.681	0.778	0.540
	TJE2	0.734		
	TJE3	0.801		
	TJE4	0.846		

(continued)

**Table 4** (continued)

Construct	Indicator	Standardized Loading (λ)	CR	AVE
Innovative Behavior	TIB1	0.742		
	TIB2	0.801		
	TIB3	0.865		
	TIB4	0.887	0.867	0.685

Note. All factor loadings are statistically significant at $p < .001$.

CR=Composite Reliability; AVE=Average Variance Extracted.

Recommended criteria: $CR \geq 0.70$; $AVE \geq 0.50$.

Table 5 Goodness-of-Fit Indices of the Measurement Model (CFA)

Fit Index	Recommended Criteria	Obtained Value	Model Fit
χ^2 / df	< 3.00	1.14	Good fit
GFI	≥ 0.90	0.974	Excellent fit
AGFI	≥ 0.90	0.958	Excellent fit
CFI	≥ 0.95	0.996	Excellent fit
TLI	≥ 0.95	0.995	Excellent fit
RMR	≤ 0.05	0.008	Excellent fit
RMSEA	≤ 0.08	0.022	Excellent fit

Note. $\chi^2 = 46.869$, $df = 41$, $p = .244$.

GFI=Goodness-of-Fit Index; AGFI=Adjusted Goodness-of-Fit Index;

CFI=Comparative Fit Index; TLI=Tucker-Lewis Index;

RMR=Root Mean Square Residual; RMSEA=Root Mean Square Error of Approximation

Discussion

The purpose of this study was to examine the mediating role of job engagement in the relationship between servant leadership and innovative behavior among educational personnel in higher vocational and technical colleges in Guangzhou, Guangdong Province, China. The findings provide important theoretical and practical insights into the mechanisms through which leadership influences innovation in vocational education contexts.

First, the results revealed that servant leadership did not have a significant direct effect on innovative behavior. This finding highlights an important empirical inconsistency with some prior studies that report a direct positive relationship between servant leadership and innovation.

However, it aligns with other research suggesting that leadership effects on innovation are often indirect and contingent upon psychological and motivational processes. This result indicates that, in the context of vocational education institutions, servant leadership alone may not be sufficient to directly stimulate innovative behavior. Instead, innovation appears to depend on internal employee states, such as motivation and engagement, which act as necessary conditions for translating leadership influence into actual behavior.

Second, servant leadership was found to have a significant positive effect on job engagement. This finding supports core assumptions of servant leadership theory, which emphasizes the role of leaders in fostering employee well-being, empowerment, and meaningful work. From a theoretical perspective, this result is consistent with motivational frameworks such as the Job Demands–Resources (JD-R) model, which posits that supportive leadership functions as a key job resource that enhances employee engagement. In the context of higher vocational and technical colleges, where educational personnel often face high job demands and institutional pressures, servant leadership plays a crucial role in strengthening employees' psychological attachment to their work.

Third, job engagement was found to significantly predict innovative behavior, reinforcing its role as a key motivational driver. This finding is consistent with prior research suggesting that engaged employees are more proactive, energetic, and willing to invest effort in creative and innovative activities. It also addresses a theoretical limitation in earlier studies that tended to treat leadership and innovation as directly linked constructs, without adequately considering the mediating role of psychological mechanisms. By demonstrating the significant effect of job engagement, this study provides a more nuanced explanation of how innovation emerges within educational organizations.

Importantly, the results confirmed that job engagement fully mediates the relationship between servant leadership and innovative behavior. This finding contributes to the literature by clarifying the underlying mechanism through which servant leadership influences innovation. Rather than exerting a direct effect, servant leadership enhances innovation indirectly by fostering higher levels of engagement among educational personnel. This mediation model extends existing research by integrating leadership theory with engagement-based perspectives, offering a more comprehensive explanation of employee innovative behavior.

From a contextual perspective, this study addresses the limited empirical evidence from higher vocational and technical colleges in China, particularly in rapidly developing urban regions such as Guangzhou. Unlike general education institutions or corporate settings, vocational education operates at the intersection of education and industry, where innovation requires both technical expertise and adaptive capacity. The findings suggest that in such contexts,



psychological engagement is a critical mechanism that enables educational personnel to respond to dynamic environmental demands. This highlights the importance of considering institutional and regional characteristics when examining leadership and innovation relationships.

From a practical standpoint, the findings suggest that institutional leaders should focus not only on adopting servant leadership practices but also on actively enhancing job engagement. Strategies such as providing professional development opportunities, fostering collaborative environments, reducing excessive administrative burdens, and recognizing innovative contributions can strengthen employees' engagement and, in turn, promote innovation.

Overall, this study contributes to both theory and practice by demonstrating that the relationship between servant leadership and innovative behavior is indirect and mediated by job engagement. It underscores the importance of psychological mechanisms in leadership research and provides a context-specific understanding of innovation in vocational education institutions.

Suggestions

Suggestions for utilizing the research results

1. Development of servant leadership competencies

Educational institutions should design and implement leadership development programs that emphasize servant leadership principles, such as empathy, ethical behavior, empowerment, and active listening. Strengthening these competencies among institutional leaders and administrators can foster a supportive work environment that enhances job engagement among educational personnel.

2. Enhancement of job engagement strategies

Higher vocational and technical colleges should adopt targeted strategies to enhance job engagement. These may include reducing excessive administrative workloads, providing continuous professional development opportunities, and establishing systems for recognizing and rewarding innovative contributions. Such practices can increase employees' vigor, dedication, and overall involvement in their work.

3. Promotion of innovation-supportive environments

Institutions should create organizational conditions that facilitate the translation of job engagement into innovative behavior. This includes allocating sufficient resources for teaching and curriculum innovation, encouraging interdisciplinary collaboration, and supporting the integration of digital technologies and industry-relevant practices. Additionally, establishing platforms such as communities of practice or innovation forums can promote knowledge sharing and continuous improvement.

Suggestions for future research

1. Expansion to different contexts Future research should examine the proposed model across different regions, institutional types, and cultural contexts to enhance the external validity and generalizability of the findings.

2. Inclusion of additional variables Further studies may incorporate additional mediating or moderating variables, such as organizational climate, psychological empowerment, or alternative leadership styles (e.g., transformational or ethical leadership), to provide a more comprehensive understanding of innovative behavior.

3. Use of longitudinal research designs Future research is encouraged to employ longitudinal designs to better capture causal relationships and examine how job engagement and innovative behavior evolve over time.

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