



RESEARCH ARTICLE

# The Relationship between Transformational Leadership, Teachers' organizational commitment, and Organizational Citizenship Behavior: An Integrated Investigation Using Meta-analysis and Structural Equation Modeling

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ARTICLE INFO	ABSTRACT
Received: Aug 18, 2024 Accepted: Oct 23, 2024	This study utilizes Meta-analysis and structural equation modeling (SEM) to explore the relationships between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior (OCB). The findings indicate that transformational leadership significantly enhances both teachers' organizational commitment and their OCB. Specifically, the effect size of transformational leadership on organizational commitment is 0.582, and on OCB is 0.454. Additionally, teachers' organizational commitment has a positive effect on OCB, with an effect size of 0.488. Path analysis further reveals that teachers' organizational commitment plays a crucial mediating role between transformational leadership and OCB, with an indirect effect of 0.262 and a total effect of 0.500. These results suggest that transformational leadership not only directly improves teachers' proactive behaviors but also indirectly promotes their OCB by increasing organizational commitment. This study provides significant empirical support and theoretical foundation for leadership practices in educational management.
<b>Keywords</b>	
Transformational Leadership	
Organizational Commitment	
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## INTRODUCTION

In today's rapidly changing and highly competitive educational environment, teachers' organizational citizenship behavior (OCB) has become one of the key factors in improving school effectiveness and enhancing educational quality. Organizational citizenship behavior refers to voluntary actions that go beyond formal role requirements, positively influencing the overall operation and performance of organizations (Podsakoff et al., 2014). Teachers' OCB not only helps build a harmonious school culture but also strengthens the cohesion and innovation capacity of schools, thereby promoting the sustainable development of educational institutions.

In recent years, transformational leadership has gained significant attention as an essential leadership style for enhancing teacher engagement and organizational performance. Transformational leadership effectively boosts teachers' job satisfaction and organizational commitment by inspiring their intrinsic motivation, establishing a shared vision, and providing individualized support (Eliophotou Menon, 2014). Previous research has demonstrated that transformational leadership has a significant positive impact on teachers' organizational citizenship behavior. However, the specific pathways and mechanisms underlying this influence remain subject to debate and uncertainty.

Organizational commitment, as a crucial mediating variable linking transformational leadership and teachers' organizational citizenship behavior, has attracted considerable scholarly attention. Organizational commitment is typically defined as teachers' sense of identification, belongingness, and willingness to continually work towards the goals of their organization (Meyer et al., 2004). High levels of organizational commitment not only enhance teachers' job satisfaction but also motivate them to actively participate in various school activities and engage in OCB beyond their formal responsibilities (Caillier, 2016). Therefore, exploring the pathways through which transformational leadership influences teachers' OCB via organizational commitment holds significant theoretical and practical implications for improving teachers' well-being and promoting overall educational quality.

This study aims to systematically investigate the mechanisms by which transformational leadership and teachers' organizational commitment impact OCB, using a combination of Meta-analysis and structural equation modeling (SEM). Specifically, this research will systematically review the existing literature, integrate the correlations among transformational leadership, teachers' organizational commitment, and OCB through Meta-analysis, and further verify and reveal the influence pathways and mechanisms through structural equation modeling.

## LITERATURE REVIEW

### **The Relationship between Transformational Leadership and Teachers' Organizational Citizenship Behavior**

In recent years, the impact of transformational leadership on enhancing teachers' organizational citizenship behavior (OCB) has become a significant topic in educational management research. Transformational leadership, through motivating teachers' intrinsic drive, establishing a shared vision, and providing individualized support, can significantly enhance teachers' organizational commitment. This leadership style not only increases teachers' sense of identification with the school but also encourages them to voluntarily go beyond their formal duties, contributing more to the overall development of the school.

In Taiwan, Chou Wan-Jung (2008) conducted a study on elementary school teachers in Taoyuan, Hsinchu, and Miaoli counties and found a significant positive correlation between principals' transformational leadership behavior and teachers' organizational commitment. Specifically, when principals demonstrated strong personal charisma and motivational abilities during leadership, teachers were more likely to exhibit high levels of OCB (Chou, 2008). Similarly, Liu Shih-Hui (2015) pointed out in a study in Kaohsiung that principals' transformational leadership behavior could enhance teachers' organizational commitment by improving their job satisfaction and sense of identification with the organization (Liu, 2015).

In international studies, Abd El Majid and Cohen (2015) found a significant positive relationship between transformational leadership and the organizational commitment and job performance of Arab teachers in Israel. Their research showed that transformational leadership fosters teachers' trust and sense of belonging, prompting them to exhibit more behaviors that benefit the school's development beyond their daily work (Abd El Majid & Cohen, 2015). Fang and Yu (2023) further demonstrated the positive impact of transformational leadership on teachers' OCB, particularly

under the context of group-focused transformational leadership (GTL). The regression coefficient of GTL on teachers' OCB was 0.881 ( $p < 0.001$ ), indicating a strong cross-level positive effect (Fang & Yu, 2023).

Based on the findings from the literature, this study proposes the following hypothesis:

**H1:** Transformational leadership has a significant positive impact on teachers' organizational citizenship behavior.

### **The Relationship Between Transformational Leadership and Teachers' Organizational Commitment**

Numerous studies investigating the relationship between transformational leadership and teachers' organizational commitment have consistently shown a significant positive effect of the former on the latter. In a study conducted by Feizi, Ebrahimi, and Beheshti (2014) on secondary school teachers in the Germe region of Iran, a significant positive correlation was found between transformational leadership style and teachers' organizational commitment, with a correlation coefficient of 0.33 ( $p < 0.01$ ). This suggests that transformational leadership can significantly enhance teachers' levels of organizational commitment. Furthermore, the study revealed that among the dimensions of transformational leadership, idealized influence had the strongest effect on teachers' organizational commitment, with a correlation coefficient of 0.35 ( $p < 0.01$ ) (Feizi et al., 2014).

Similarly, a study by Khasawneh, Omari, and Abu-Tineh (2012) on vocational school teachers in Jordan yielded comparable findings. The research indicated a significant positive relationship between principals' transformational leadership behaviors and vocational teachers' organizational commitment. The total score of transformational leadership was correlated with teachers' organizational commitment, with a correlation coefficient of 0.50 ( $p < 0.001$ ). Among the four key dimensions of transformational leadership, "inspirational motivation" had the greatest impact on teachers' organizational commitment, with a correlation coefficient of 0.42 ( $p < 0.001$ ), followed by "individualized consideration" at 0.38 ( $p < 0.001$ ), "intellectual stimulation" at 0.31 ( $p < 0.001$ ), and "idealized influence" at 0.28 ( $p < 0.001$ ). Although the latter showed a weaker correlation, it was still statistically significant (Khasawneh et al., 2012).

Additionally, a study by Li Ling et al. (2018) in mainland China explored the relationship between school transformational leadership and teachers' organizational commitment. The results showed a significant positive correlation between school transformational leadership and teachers' organizational commitment. Specifically, various dimensions of transformational leadership, such as vision inspiration, intellectual stimulation, charismatic influence, and individualized consideration, had a significant positive predictive effect on teachers' organizational commitment. Among these, vision inspiration and intellectual stimulation contributed the most to teachers' organizational commitment, accounting for 34.6% and 22.5%, respectively ( $p < 0.001$ ). In contrast, charismatic influence and individualized consideration had relatively smaller contributions, at 15.6% and 15.0%, respectively ( $p < 0.001$ ) (Li Ling et al., 2018).

Based on the findings from the above literature, the following hypothesis is proposed:

**H2:** Transformational leadership has a significant positive impact on teachers' organizational commitment.

### **The Relationship between Teachers' Organizational Commitment and Organizational Citizenship Behavior**

The relationship between organizational commitment and organizational citizenship behavior (OCB) has been widely explored in various studies, all of which demonstrate a significant positive correlation.

First, the research by Nassir and Benoliel (2024) shows that teachers' organizational commitment significantly predicts their OCB, with a correlation coefficient of 0.372 ( $p < 0.001$ ) (Nassir & Benoliel, 2024). This indicates that the stronger the teachers' emotional commitment to the school, the more likely they are to exhibit behaviors that go beyond their job requirements. Similarly, the study by Aftab et al. (2020) supports this conclusion, finding that the correlation coefficient between organizational commitment and OCB was 0.16 ( $p < 0.05$ ) (Aftab et al., 2020), suggesting that as teachers' organizational commitment increases, they display more OCB.

Further research has examined the relationship between different dimensions of organizational commitment and various dimensions of OCB. Terzi (2015) pointed out in his study that teachers' organizational commitment significantly predicts OCB, with regression analysis showing that organizational commitment explains 22% of the total variance in OCB ( $R^2 = 0.22$ ,  $p < 0.01$ ), and the regression coefficient was 0.47 (Terzi, 2015). Specifically, internalized commitment had the strongest correlation with teachers' conscientiousness and helping behaviors, with correlation coefficients of 0.53 and 0.44, respectively ( $p > 0.01$ ). In contrast, compliance commitment did not show a significant relationship with OCB.

Additionally, Bragger et al. (2005) also found that organizational commitment significantly predicts teachers' OCB (Bragger et al., 2005). When teachers have higher commitment to the organization, they are more likely to exhibit extra-role behaviors that benefit the organization.

Based on the findings from the above literature, the following hypothesis is proposed:

**H3:** Teachers' organizational commitment has a significant positive impact on organizational citizenship behavior.

### **Research on Transformational Leadership, Teachers' Organizational Commitment, and Organizational Citizenship Behavior**

In recent studies, increasing evidence suggests that transformational leadership not only directly influences teachers' organizational citizenship behavior (OCB) but also indirectly enhances this impact through organizational commitment as a critical mediating variable.

First, Shie and Chang (2022) investigated how authentic leadership within leadership behavior influences teachers' organizational commitment through two mediating variables: organizational commitment and organizational identification. Their results showed that organizational commitment had a significant effect on teachers' OCB, with a regression coefficient of 0.245 ( $p < 0.05$ ), while organizational identification had an even more substantial effect on OCB, with a regression coefficient of 0.337 ( $p < 0.05$ ) (Shie & Chang, 2022). This indicates that authentic leadership can promote teachers' commitment and identification with the organization, encouraging them to exhibit behaviors that go beyond their formal duties. Leaders who demonstrate authenticity and transparency inspire teachers' strong sense of belonging and responsibility toward the school, thus enhancing organizational commitment.

Following this, the study by Phetsombat and Na-Nan (2023) further explored how transformational leadership, as a positive leadership behavior, indirectly increases teachers' OCB by strengthening their organizational commitment. Their findings indicated a significant positive correlation between teachers' organizational commitment and their OCB, with a correlation coefficient of 0.355 ( $p < 0.01$ ) (Phetsombat & Na-Nan, 2023). This emphasizes the pivotal role of organizational commitment in promoting voluntary behaviors and teamwork among teachers.

Finally, the study by Chen Haoting (2013) more directly examined the relationships between transformational leadership, teachers' organizational commitment, and OCB. The results indicated that transformational leadership had a significant positive impact on teachers' OCB, with organizational commitment acting as a partial mediator in this relationship (Chen, 2013). Specifically,

the data showed that when considering the direct impact of transformational leadership on OCB, the regression coefficient was 0.603 ( $p < 0.01$ ). However, when organizational commitment was introduced as a mediating variable, the effect of transformational leadership on OCB decreased to 0.277, while the effect of organizational commitment on OCB was 0.474 ( $p < 0.01$ ). These results clearly demonstrate that transformational leadership not only directly motivates teachers' positive behaviors but also further enhances their OCB through the mediating role of organizational commitment.

Based on the findings from the above literature, the following hypothesis is proposed:

**H4:** Teachers' organizational commitment mediates the relationship between transformational leadership and organizational citizenship behavior.

## **RESEARCH DESIGN**

### **Research Framework**

This study combines Meta-analysis and structural equation modeling (SEM) to explore the relationships between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior (OCB). First, the Meta-analysis systematically and quantitatively analyzes results across studies, confirming the positive effects of transformational leadership on teachers' organizational commitment and OCB, as well as the facilitating role of teachers' organizational commitment in promoting OCB. Based on these findings, SEM path analysis further quantifies these relationships, showing that teachers' organizational commitment serves as a significant mediating variable between transformational leadership and OCB. The combination of these methods provides scientific evidence and theoretical support for comprehensively understanding the role of transformational leadership in educational management (VISWESVARAN & ONES, 1995).

### **Sample Collection**

In theory, the Meta-analysis should include all accessible published and unpublished research results, covering four main types of literature: books, journal articles, dissertations, and unpublished works. However, Rosenthal (1991) found that there is no evidence that certain sources are more prone to bias than others among these four categories (Rosenthal, 1991). Therefore, this study primarily draws from journal articles and dissertations as its literature sources, with adjustments made for potential sampling biases in the research.

The time span of this study covers literature from January 2001 to August 2024. Keywords such as "Transformational Leadership," "Organizational Citizenship Behavior," and "Organizational Commitment" were used as the initial search criteria. The study utilized Chinese and English databases, including CNKI, WANFANG DATA, Airiti Library, Web of Science, Elsevier Science, EBSCO, PsycINFO (for psychology-related studies), and ERIC (for education-related studies). Duplicate records were eliminated, and studies not aligned with the research theme and objectives were removed. To ensure comprehensive coverage, a citation tracing method was employed on the initially screened literature, using references from literature reviews and related papers to identify additional potential sources.

### **Inclusion Criteria**

To ensure the quantitative requirements of the Meta-analysis are met and to reduce heterogeneity among the studies, a set of strict selection criteria was established to filter the relevant literature. First, this study only includes research papers written in either Chinese or English to minimize language interpretation errors and ensure the researchers' high proficiency in the language. Each piece of literature must clearly indicate the author(s), publication year, and type of document.

Second, the selected studies must be confined to the educational context and focus on the correlation between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior (OCB), using quantitative research methods and questionnaire surveys; qualitative studies were excluded from the analysis. Third, the literature must provide clear correlation coefficients ( $r$  values), sample sizes, and Cronbach's  $\alpha$  values for the variables. Studies that only employed canonical correlation, multiple regression analysis, or structural equation modeling without reporting correlation coefficients were excluded. Finally, to ensure the timeliness and completeness of the data, when multiple studies used the same sample, the most recent results were prioritized, and literature with more comprehensive data was selected for Meta-analysis if there were overlapping contents.

### Data Coding

During the data coding phase, the study first established the coding parameters through a joint discussion among the three authors, which included basic study information (such as author name and publication date), sample size, variable correlation values (effect sizes), document type (journal articles or dissertations), and Cronbach's  $\alpha$  values. Subsequently, the first and second authors independently completed the initial coding using Excel software. After the coding was completed, the third author facilitated a review session where all three authors examined the coding results together. Any discrepancies were resolved through further discussion until consensus was reached, ensuring a coding consistency rate of over 90%. Following this, the study utilized CMA 3.0 (Comprehensive Meta-analysis 3.0) software to analyze the filtered literature, calculate the combined effect size, and examine heterogeneity and publication bias within the research sample.

### Data Processing

This study used CMA 3.0 statistical analysis software to input the required data for analysis, including the researcher, correlation coefficients, sample sizes, and other relevant information. Since the data collected from each study was presented in the form of correlation coefficients  $r$ , this study followed the method proposed by Schmidt and Hunter (2015), applying the R-Fisher's Z-R transformation process. The correlation coefficients were adjusted, and the sample size was used as a weighting factor (Schmidt & Hunter, 2015). This method is based on the assumption that the larger the sample size, the higher the accuracy of the study, and thus, greater weight should be assigned to it.

The formula for Fisher's  $z$  transformation of the correlation values is:

$$z = 0.5 \cdot \ln\left(\frac{1+r}{1-r}\right)$$

The term  $\ln$  represents the natural logarithm. Fisher's  $z$  transformation is commonly used to improve the normality of correlation coefficients during statistical analysis.

The inverse of Fisher's  $z$  transformation, used to convert Z scores back to Pearson correlation coefficients  $r$ , is as follows:

$$r = \frac{e^{2z} - 1}{e^{2z} + 1}$$

The symbol  $e$  represents the base of the natural logarithm. This formula is used to convert Fisher's Z scores back to the original correlation coefficients. Additionally, the formula for calculating the 95% confidence interval is as follows:

$$\text{Lower} = \bar{ES} - Z_{(1-\alpha)} \times SE_{\bar{ES}}$$

$$\text{Upper} = \bar{ES} + Z_{(1-\alpha)} \times SE_{\bar{ES}}$$

## RESEARCH RESULTS

### Coding Results

After the sample collection and the application of inclusion criteria, a total of 38 studies met the requirements and were subjected to data coding. For studies examining the relationship between transformational leadership and teachers' organizational citizenship behavior (hereafter referred to as AD), 17 articles were included in the analysis, with correlation coefficients ranging from 0.3 to 0.588 and a total sample size of 9,120 participants. For studies on the relationship between transformational leadership and teachers' organizational commitment (hereafter referred to as AC), 18 articles were included, with correlation coefficients ranging from 0.306 to 0.828 and a total sample size of 12,086 participants. For studies on the relationship between teachers' organizational commitment and organizational citizenship behavior (hereafter referred to as CD), 13 articles were included, with correlation coefficients ranging from 0.16 to 0.762 and a total sample size of 5,868 participants. The coding results are summarized in Table 1.

**Table 1 Summary of Coding Results**

Transformational Leadership*Organizational Citizenship Behavior								
Number	Researcher	Year	Language	Form	r	Sample Size	TFL Cronbach's $\alpha$	OCB Cronbach's $\alpha$
AD01	Huang Baixun	2004	Chinese	Thesis	0.333	750	0.925	0.932
AD02	Zeng Jinfang	2004	Chinese	Thesis	0.411	736	0.974	0.874
AD03	Liao Dawei	2005	Chinese	Thesis	0.588	645	0.929	0.934
*AD04	Wu Jiancai	2008	Chinese	Thesis	0.309	354	0.942	0.914
AD05	Xu Wennan	2008	Chinese	Thesis	0.352	358	0.969	0.901
AD06	Zhou Wanrong	2008	Chinese	Thesis	0.521	945	0.977	0.919
AD07	Ding Yingzhe	2008	Chinese	Thesis	0.525	755	0.981	0.956
*AD08	Lü Wangze	2008	Chinese	Thesis	0.553	646	0.880	0.927
AD09	Wu Yuxin	2010	Chinese	Thesis	0.54	537	0.975	0.947
*AD10	Chen Haoting	2013	Chinese	Thesis	0.546	344	0.970	0.865
*AD11	Huang Suqing	2014	Chinese	Thesis	0.419	280	0.935	0.912
*AD12	Abd El Majid & Cohen	2015	English	Journal	0.3	1268	0.950	0.700
AD13	Abu Nasra & Heilbrunn	2016	English	Journal	0.56	211	0.850	0.850
AD14	Chen Xiangjun	2019	Chinese	Thesis	0.334	310	0.968	0.921
AD15	Lin Yuming	2019	Chinese	Thesis	0.399	208	0.947	0.783
AD16	Deng Cong	2020	Chinese	Thesis	0.401	562	0.956	0.935
AD17	Abu Nasra	2020	English	Journal	0.54	211	0.850	0.850

<b>Transformational Leadership*Teachers' Organizational Commitment</b>								
Number	Researcher	Year	Language	Form	r	Sample Size	TFL Cronbach's $\alpha$	TOC Cronbach's $\alpha$
AC01	Cai Jinxiong	2005	Chinese	Journal	0.624	897	0.976	0.903
AC02	Fan Chihwen	2005	Chinese	Journal	0.7	1062	0.944	0.945
AC03	Qin Mengqun, Wu Jingfu	2006	Chinese	Journal	0.633	1035	0.976	0.850
AC04	Cao Keyan	2007	Chinese	Thesis	0.575	402	0.920	0.910
*AC05	Wu Jiancai	2008	Chinese	Thesis	0.459	354	0.942	0.839
*AC06	Lü Wangze	2008	Chinese	Thesis	0.683	646	0.880	0.939
AC07	Li Dongjiao	2010	Chinese	Thesis	0.306	202	0.955	0.802
AC08	Khasawneh et al	2012	English	Journal	0.5	340	0.890	0.920
AC09	Tu Donglong	2013	Chinese	Journal	0.65	547	0.980	0.930
*AC10	Chen Haoting	2013	Chinese	Thesis	0.685	344	0.970	0.866
AC11	Feizi et al	2014	English	Journal	0.33	196	0.800	0.800
*AC12	Huang Suqing	2014	Chinese	Thesis	0.57	280	0.935	0.887
*AC13	Abd El Majid & Cohen	2015	English	Journal	0.51	1268	0.950	0.730
AC14	Xie Caihong	2017	Chinese	Journal	0.513	198	0.802	0.835
AC15	Li Ling et al	2018	Chinese	Journal	0.828	2196	0.971	0.906
AC16	Li Shengnan	2019	Chinese	Thesis	0.622	484	0.936	0.923
AC17	Han Xiaomin	2020	Chinese	Journal	0.488	650	0.943	0.754
AC18	Zhang Wanying & Mao Yaqing	2022	Chinese	Journal	0.498	985	0.905	0.913
<b>Teachers' Organizational Commitment→Organizational Citizenship Behavior</b>								
Number	Researcher	Year	Language	Form	r	Sample Size	TOC Cronbach's $\alpha$	OCB Cronbach's $\alpha$
CD01	Bragger et al	2005	English	Journal	0.23	203	0.830	0.890
*CD02	Wu Jiancai	2008	Chinese	Thesis	0.476	354	0.839	0.914
*CD03	Lü Wangze	2008	Chinese	Thesis	0.544	646	0.939	0.927
*CD04	Chen Haoting	2013	Chinese	Thesis	0.557	344	0.866	0.865
CD05	Chen Meijuan	2013	Chinese	Thesis	0.571	433	0.905	0.931



*CD06	Huang Suqing	2014	Chinese	Thesis	0.762	280	0.887	0.912
*CD07	Abd El Majid & Cohen	2015	English	Journal	0.26	1268	0.730	0.700
CD08	Terzi, A. R	2015	English	Journal	0.47	332	0.840	0.890
CD09	Cai Yingren	2016	Chinese	Thesis	0.709	246	0.961	0.940
CD10	Aftab et al	2020	English	Journal	0.16	250	0.860	0.700
CD11	Shie & Chang	2022	English	Journal	0.607	783	0.856	0.769
CD12	Phetsombat & Na-Nan	2023	English	Journal	0.355	379	0.931	0.939
CD13	Nassir & Benoliel	2024	English	Journal	0.372	350	0.700	0.920
A=TFL=Transformational Leadership C=TOC=Teachers' Organizational Commitment D=OCB=Organizational Citizenship Behavior								

Note: \* indicates that 5 of the same studies were included in the analysis of all three variable relationships.

### Heterogeneity Test Results

For testing the heterogeneity of effect sizes, this study primarily employed the Q test (Cochrane Q test), P-value test,  $I^2$  heterogeneity index, and  $\tau^2$  value. The Q statistic (including the P-value test) is used to determine the presence of heterogeneity. The  $I^2$  heterogeneity index, which ranges from 0% to 100%, categorizes heterogeneity into three levels: 25% (low), 50% (moderate), and 75% (high). The  $\tau^2$  value indicates the degree of heterogeneity in the dispersion of effect sizes, with larger values indicating greater heterogeneity between groups.

As shown in the Meta-analysis results Table 2 for the A→C path, the Q statistic was 663.982 with 17 degrees of freedom, a P-value of 0,  $I^2$  of 97.44%, and  $\tau^2$  of 0.059, indicating significant heterogeneity and suggesting considerable variation among studies.

For the A→D path, the Q statistic was 149.791 with 16 degrees of freedom, a P-value of 0,  $I^2$  of 89.318%, and  $\tau^2$  of 0.016, similarly demonstrating significant heterogeneity.

For the C→D path, the Q statistic was 282.562 with 12 degrees of freedom, a P-value of 0,  $I^2$  of 95.793%, and  $\tau^2$  of 0.052, indicating significant heterogeneity.

Since the  $I^2$  values for all three relationships exceed 75%, this indicates that nearly all the variation is due to heterogeneity between studies rather than random error. In such high-heterogeneity situations, a random-effects model is more appropriate than a fixed-effects model. Therefore, the subsequent research in this study mainly adopts the random-effects model to explore potential moderating variables, aiming to better understand the heterogeneity of effect sizes.

**Table 2 Summary of Meta-analysis Results (Including Heterogeneity Outcomes)**

		Meta-Analysis Results						Heterogeneity Findings				
	Mode	Number Studies	Point estimate	95%CI		Z	P	Q	df (Q)	P	$I^2$ (%)	$\tau^2$
A→C	Fixed	18	0.642	0.631	0.652	83.529	0	663.982	17	0	97.44	0.059
	Random	18	0.582	0.501	0.652	11.415	0					

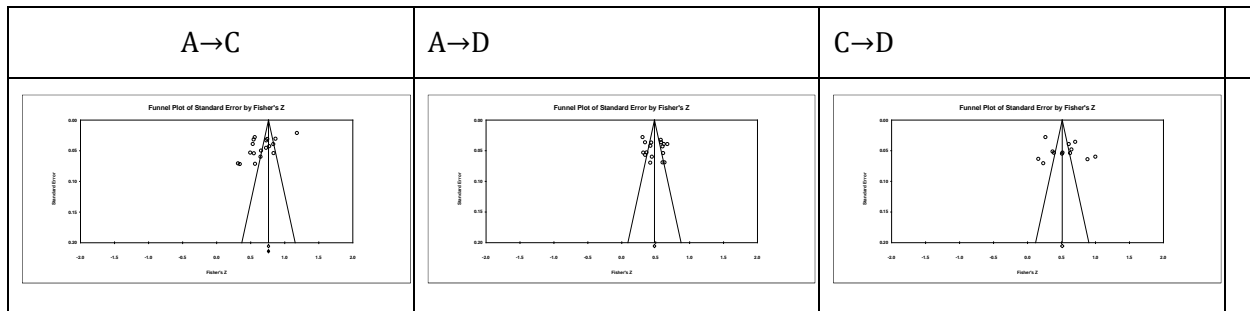
A→D	Fixed	17	0.448	0.431	0.464	45.9 14	0	149.7 91	16	0	89.3 18	0.01 6
	Rando m	17	0.454	0.401	0.504	14.8 91	0					
C→D	Fixed	13	0.470	0.450	0.490	38.9 68	0	282.5 62	12	0	95.7 93	0.05 2
	Rando m	13	0.488	0.385	0.579	8.20 9	0					

**Publication Bias Test Results**

Sharpe (1997) mentioned that some important studies may not be included in the analysis by researchers, and it is impossible to collect all similar studies (a census), leading to publication bias (omitted values) (Sharpe, 1997). The funnel plot is a primarily visual tool used to assess publication bias. If the plot is symmetrical around the central effect size, it suggests the absence of publication bias. However, since this method may involve some subjectivity, this study also employed Egger's linear regression test, the non-parametric rank correlation test (Begg's test), and the fail-safe N as supplementary verification methods.

As seen in Table 3, the effect sizes for the A→C, A→D, and C→D studies are mainly concentrated at the top of the funnel plots and centered around the average effect size, showing a symmetrical distribution. This indicates that there is no publication bias present.

**Table 3 Funnel Plots for A→C, A→D, and C→D Studies**



**Table 4 Publication Bias Test Results for A→C, A→D, and C→D Studies**

	Egger's linear regression test					the non-parametric rank correlation (Begg) test				Classic Fail-safe N					
	beta 1	SE	t	d f	p(2-tailed)	Kendall's score	tau	z	p (2-tailed)	z	p	Al ph a	z for Alpha	k	Fail-safe N
A → C	-11.239	3.557	3.16	16	0.006	-37	-0.242	1.401	0.161	73.352	0	0.05	1.96	18	5194
A → D	1.59	2.893	0.549	15	0.591	-3	-0.022	0.124	0.902	44.758	0	0.05	1.96	17	8849
C → D	4.338	5.035	0.861	11	0.407	-2	-0.26	0.122	0.903	38.66	0	0.05	1.96	13	5046

Based on the results in Table 4, regarding the relationship between Transformational Leadership (TFL) and Teachers' Organizational Commitment (TOC), Egger's regression test shows an intercept of -11.239, a standard error of 3.557, and a t-value of 3.16, with a p-value of 0.006 at 16 degrees of

freedom. This significant result suggests the possibility of publication bias. However, Begg's test did not support this conclusion, with Kendall's score of  $-37$ , a tau value of  $-0.242$ , a z-value of  $1.401$ , and a corresponding p-value of  $0.161$ , indicating a lower likelihood of bias.

According to the findings by Rhoades and Eisenberger (2002) and Rosenthal (1979), the Fail-safe N should be five times the number of studies included in the analysis ( $k$ ) plus 10, following the "5k + 10" rule (Rhoades & Eisenberger, 2002) (Rosenthal, 1991). The classic Fail-safe N analysis shows that this relationship is robust, with a Fail-safe N value of  $5,194$ , indicating that even if a large number of null studies were added, the current conclusions would remain stable. In conclusion, this study finds no significant publication bias in the research on the relationship between transformational leadership and organizational commitment, allowing the use of the current aggregated effect size for further research.

Additionally, for the relationship between Transformational Leadership (TFL) and Organizational Citizenship Behavior (OCB), the Egger's regression test results show an intercept of  $1.59$ , a standard error of  $2.893$ , a t-value of  $0.549$ , and 15 degrees of freedom with a corresponding p-value of  $0.591$ , which does not reach statistical significance, indicating a lower likelihood of publication bias. The Begg test further supports this conclusion, with Kendall's score of  $-3$ , a tau value of  $-0.022$ , a z-value of  $0.124$ , and a p-value of  $0.902$ . Moreover, the classic Fail-safe N analysis shows that this relationship is robust, with a Fail-safe N value of  $8,849$ , further confirming the reliability of the research results. Taking all factors into consideration, this study concludes that there is no significant publication bias in the research on the relationship between transformational leadership and organizational citizenship behavior, and the current aggregated effect size can be used for further research.

Lastly, regarding the relationship between Teachers' Organizational Commitment (TOC) and Organizational Citizenship Behavior (OCB), the Egger's regression test results show an intercept of  $4.338$ , a standard error of  $5.035$ , a t-value of  $0.861$ , and a p-value of  $0.407$  at 11 degrees of freedom, showing no significant signs of publication bias. Similarly, the Begg test results did not indicate bias, with Kendall's score of  $-2$ , a tau value of  $-0.26$ , a z-value of  $0.122$ , and a p-value of  $0.903$ . Additionally, the classic Fail-safe N analysis shows high robustness in this relationship, with a Fail-safe N value of  $5,046$ , indicating that even in the presence of unpublished null studies, the research conclusions remain solid. Taking all factors into account, this study concludes that there is no significant publication bias in the research on the relationship between teachers' organizational commitment and organizational citizenship behavior, allowing the use of the current aggregated effect size for further research.

## PATH ANALYSIS RESULTS

To verify the relationship model between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior, correlation coefficients between the variables were used, and a weighted mean value based on the random-effects model was applied to establish the corresponding matrix, as shown in.

**Table 5 Meta-analysis Effect Size Correlation Matrix Based on Structural Equation Modeling**

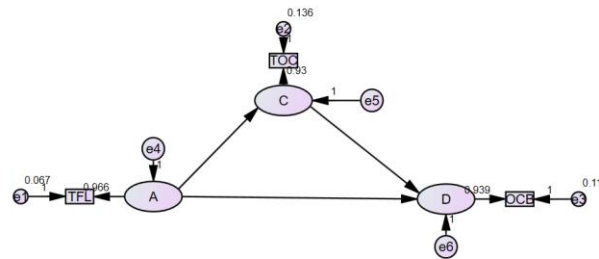
Variable	Cronbach's $\alpha$	1- $\alpha$	$\sqrt{\alpha}$	A	B	C
A	0.933	0.067	0.966	1		
C	0.864	0.136	0.930	0.582	1	
D	0.881	0.119	0.939	0.454	0.488	1

After establishing the correlation matrix, the harmonic mean of the sample sizes for the three research themes—transformational leadership, teachers' organizational commitment, and organizational citizenship behavior—was calculated. The harmonic mean is the reciprocal of the average of the reciprocals of the sample sizes and is used as the sample size for structural equation modeling validation. The formula for calculating the harmonic mean is as follows:

$$H = \frac{1}{\frac{1}{m} \sum_{i=1}^m \frac{1}{n_i}}$$

Where, *m* represents the number of correlation coefficients, *n<sub>i</sub>* is the sample size corresponding to the *i* correlation coefficient.

Referring to the method of Viswesvaran and Ones (1995), the sample sizes of 12086, 9120, and 5868 were used, and the harmonic mean of these three values was calculated as 8,269, which was used as the sample size for the model validation analysis. According to the reliability setting principles of structural equation modeling, the variance of measurement errors was set to 1- $\alpha$  (where  $\alpha$  is the average reliability), and the unstandardized factor loadings were also set accordingly  $\sqrt{\alpha}$ . The sample size for the model was determined using the harmonic mean of the sample sizes from the various studies (*n* = 8,269), and AMOS 24.0 software was used to conduct the path analysis to validate the conceptual model, as shown in **Figure 1**. The model was estimated using the maximum likelihood method, and both the CFI and GFI values reached 1.000, demonstrating an excellent model fit and fully reflecting the consistency between the observed data and the expected model.



**Figure 1 Path Framework Diagram**

**Direct Effects**

The direct effects, or path coefficients, are presented in Table 6. The estimated effect of Transformational Leadership (A) on Teachers' Organizational Commitment (C) is 0.648, with a standard error of 0.1, and a critical ratio (C.R.) of 64.906. The P-value is indicated as \*\*\*, representing a highly significant result. The estimated effect of Teachers' Organizational Commitment (C) on Teachers' Organizational Citizenship Behavior (D) is 0.405, with a standard error of 0.015, and a critical ratio of 26.861, also highly significant. Additionally, the direct effect of Transformational Leadership (A) on Teachers' Organizational Citizenship Behavior (D) is estimated at 0.238, with a standard error of 0.015 and a critical ratio of 16.377, which is likewise highly significant.

**Table 6 Summary of Path Analysis Results**

DV <--- IV	Estimate	S.E.	C.R.	P	
C <--- A	0.648	0.1	64.906	<0.001	***
D <--- C	0.405	0.015	26.861	<0.001	***
D <--- A	0.238	0.015	16.377	<0.001	***
***P<0.001					

## Indirect Effects

In line with the research hypothesis, the indirect effects refer to the impact of the independent variable on the dependent variable through the mediator. As shown in **Figure 1**, in this model, Transformational Leadership (A) is the independent variable, Teachers' Organizational Citizenship Behavior (D) is the dependent variable, and Teachers' Organizational Commitment (C) serves as the mediator. This study used the Monte Carlo confidence interval method to estimate the mediation effect. This method calculates the confidence interval for the product of coefficients  $a \times b$  based on the point estimates of coefficients  $a$  and  $b$ , to assess the significance of the mediation effect (Preacher & Selig, 2012).

The total effect of Transformational Leadership (A) on Teachers' Organizational Citizenship Behavior (D) is 0.5, which includes the direct effect (0.238) and the indirect effect through Teachers' Organizational Commitment (C) (0.262). Teachers' Organizational Commitment (TOC) is strongly influenced by Transformational Leadership (A) (0.648), and Teachers' Organizational Citizenship Behavior (OCB) is affected by both variables (A: 0.238, C: 0.405). The specific effect values are shown in Table 7.

**Table 7 Direct, Indirect, and Total Effects**

Path	Direct	Indirect	Total Effects Table	Standardized Direct Effects	Standardized Indirect Effects	Standardized Total
C <--- A	0.648	NA	0.648	0.648	NA	0.648
D <--- C	0.405	NA	0.405	0.405	NA	0.405
D <--- A	0.238	0.262	0.5	0.238	0.262	0.5

Note: "C.R." stands for Critical Ratio. "NA" stands for Not Applicable, which means it is not applicable for fixed parameters or when the standard error and C.R. values for calculated indirect effects are not provided.

## DISCUSSION

### The Positive Effects of Transformational Leadership on Teachers' Organizational Commitment, Organizational Citizenship Behavior, and the Impact of Organizational Commitment on Organizational Citizenship Behavior

This study analyzed the relationships based on four hypotheses. Hypothesis 1 proposed that Transformational Leadership (TFL) has a significant positive impact on Teachers' Organizational Citizenship Behavior (OCB). Hypothesis 2 assumed that Transformational Leadership also has a significant positive effect on Teachers' Organizational Commitment (TOC). The results of the Meta-analysis using a random-effects model showed that the effect size of Transformational Leadership on Organizational Citizenship Behavior was 0.454 [95% CI: 0.401, 0.504], with a Z-value of 14.891 and a P-value of 0.000. The effect size of Transformational Leadership on Teachers' Organizational Commitment was 0.582 [95% CI: 0.501, 0.652], with a Z-value of 11.415 and a P-value of 0.000. These results support both Hypothesis 1 and Hypothesis 2.

Hypothesis 3 proposed that Teachers' Organizational Commitment has a significant positive impact on Organizational Citizenship Behavior. The Meta-analysis showed that the effect size of Teachers' Organizational Commitment on Organizational Citizenship Behavior was 0.488 [95% CI: 0.385, 0.579], with a Z-value of 8.209 and a P-value of 0.000, supporting Hypothesis 3. The AMOS path analysis results further validated these relationships, showing that the standardized path coefficient of Transformational Leadership on Teachers' Organizational Commitment was 0.648, while the direct standardized path coefficient on Organizational Citizenship Behavior was 0.238. Additionally, the direct standardized path coefficient of Teachers' Organizational Commitment on Organizational Citizenship Behavior was 0.405.

These findings collectively support the hypothesis that Transformational Leadership directly enhances both Teachers' Organizational Commitment and Organizational Citizenship Behavior, and further influences Organizational Citizenship Behavior through the mediating role of Teachers' Organizational Commitment.

### **The Mediating Role of Organizational Commitment between Transformational Leadership and Organizational Citizenship Behavior**

Hypothesis 4 proposed that Teachers' Organizational Commitment mediates the relationship between Transformational Leadership and Organizational Citizenship Behavior. The Meta-analysis results indicated that the effect size of Transformational Leadership on Teachers' Organizational Commitment was 0.582, while the effect size of Teachers' Organizational Commitment on Organizational Citizenship Behavior was 0.488, supporting the hypothesis that Teachers' Organizational Commitment acts as a mediating variable.

The AMOS path analysis further revealed that the indirect effect of Transformational Leadership on Organizational Citizenship Behavior through Teachers' Organizational Commitment was 0.262, while the direct effect was 0.238, with a total effect of 0.500. These results confirmed Hypothesis 4, indicating that Teachers' Organizational Commitment plays a partial mediating role in the influence of Transformational Leadership on Organizational Citizenship Behavior.

In conclusion, the analysis results of Hypotheses 1 to 4 demonstrate that Transformational Leadership enhances Teachers' Organizational Commitment, both directly and indirectly, and promotes Organizational Citizenship Behavior. This finding holds significant reference value for research in educational management and leadership.

### **AUTHORS' CONTRIBUTIONS**

This article is part of my ongoing doctoral dissertation, titled "The Impact of Transformational Leadership on Teachers' Organizational Citizenship Behavior: The Mediating Role of Job Satisfaction and Organizational Commitment — A Study Based on Meta-Analysis and Structural Equation Modeling". The dissertation has passed the proposal defense and I have successfully obtained the ethical review qualification certificate. I would like to express my sincere gratitude to Professors Lynne Lee and Hui-Wen Vivian Tang for their valuable guidance and support throughout the writing process.

### **Research Limitations**

This study revealed the overall positive relationship between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior. However, it did not delve into how different dimensions within these variables interact with one another. Additionally, the study only used journal articles and dissertations as data sources, excluding other types of research outputs, which may limit the generalizability of the findings. In the methodology section, the study analyzed only one correlation metric, the Pearson correlation coefficient, without considering other metrics such as the Spearman correlation coefficient and regression coefficient (b value). This may introduce some bias into the results.

To overcome these limitations, future research should consider breaking down these variables into more detailed sub-dimensions. For instance, transformational leadership could be subdivided into components such as inspirational motivation, individualized consideration, and intellectual stimulation, allowing for a more precise analysis of the relationships between specific dimensions. This would provide a deeper understanding of the dynamics at play. Additionally, future studies should incorporate more diverse data sources and research outputs, as well as adopt multiple evaluation metrics, to enhance the generalizability, accuracy, and reliability of the findings.

Moreover, in this study's literature review, job satisfaction (B = Job Satisfaction) was frequently mentioned as a key variable. However, due to space limitations, its role in the relationship between transformational leadership, teachers' organizational commitment, and organizational citizenship behavior was not explored in depth. Future research should focus on job satisfaction and integrate it into the analysis framework to comprehensively reveal its mediating or moderating role in these relationships. By exploring the role of job satisfaction in this process, existing theoretical frameworks can be further enriched, offering stronger support and explanations for how transformational leadership affects teachers' organizational commitment and organizational citizenship behavior.

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