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A STUDY ON ORGANIZATIONAL COMMITMENT AND TEACHER RETENTION AMONG SCHOOL TEACHERS IN TIRUCHIRAPPALLI DISTRICT

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RESEARCH ARTICLE

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Abstract

The present study investigates the factors contributing to organizational commitment among school teachers and explores the impact of such commitment on teacher retention in the Tiruchirappalli District of Tamil Nadu. In a changing educational landscape where teacher turnover poses serious challenges, understanding the psychological and institutional factors influencing teachers' decisions to stay is crucial for policy makers and school administrators. The study is based on data collected from 386 respondents working in both government and private schools. A structured questionnaire was used to capture key dimensions such as job satisfaction, work environment, organizational commitment, and teacher retention. Analytical tools including descriptive statistics, regression analysis, independent samples t-test, and one-way ANOVA were employed to test the hypotheses. The results revealed that job satisfaction significantly predicts organizational commitment, and that favorable work environments enhance teachers' organizational loyalty. Furthermore, the study established that organizational commitment has a strong influence on teacher retention, with government school teachers showing significantly higher levels of commitment than their private school counterparts. Demographic analysis showed that the teaching workforce is predominantly female, professionally qualified, and mid-career, with a majority holding permanent positions. The study concludes with practical recommendations to improve job satisfaction and work conditions, especially in private institutions, to promote long-term teacher engagement and retention.

Keywords: Organizational Commitment, Teacher Retention, Job Satisfaction, Work Environment, School Teachers

Introduction

Organizational commitment has emerged as a crucial concept in the educational sector, where teacher dedication significantly contributes to institutional stability and student achievement. It reflects the psychological attachment and loyalty of employees towards their organizations. Among school teachers, organizational commitment is particularly important, as it influences not only their motivation and performance but also their decision to remain in or leave the teaching profession.

In India, especially in districts like Tiruchirappalli in Tamil Nadu, schools often grapple with teacher attrition, job dissatisfaction, and retention challenges. These problems, if left unaddressed, can adversely impact the quality of education and disrupt the learning continuity for students. Understanding what factors contribute to organizational commitment is essential to develop effective strategies to retain experienced and capable teachers.

Previous research highlights multiple dimensions influencing organizational commitment—such as job satisfaction, work-life balance, leadership practices, professional development opportunities, and interpersonal relationships at the workplace. However, there remains a need to contextualize these factors within specific geographical and socio-economic settings like Tiruchirappalli. Moreover, the direct link between organizational commitment and teacher retention has not been fully explored in this region.

This study aims to fill this research gap by identifying the key determinants of organizational commitment among school teachers in Tiruchirappalli district and by exploring how these affect their intention to remain in the teaching profession.

Review of Literature

Meyer and Allen (1991) proposed a three-component model of organizational commitment: affective (emotional attachment), continuance (perceived cost of leaving), and normative (sense of obligation). These dimensions have been widely used to assess commitment levels among employees, including teachers.

Singh and Billingsley (1996) found that work conditions, administrative support, and role clarity significantly influence teacher commitment. Their study emphasized that lack of support from school administration leads to burnout and attrition.

Firestone and Pennell (1993) suggested that opportunities for professional growth and teacher empowerment positively affect organizational commitment, thereby reducing teacher turnover.

Jyoti and Sharma (2011) investigated the impact of transformational leadership on organizational commitment in Indian schools and concluded that supportive leadership is a strong predictor of teacher loyalty.

Ingersoll (2001) pointed out that schools with high teacher turnover often experience a decline in school performance, indicating the importance of retaining committed educators.

Despite numerous studies at national and international levels, there is a limited amount of empirical research focusing specifically on teachers in semi-urban districts like Tiruchirappalli. Most studies concentrate on urban schools or general organizational settings, making it difficult to generalize the findings to different regional contexts.

Research Gap

Although several studies have explored organizational commitment in educational settings, few have focused on the specific context of school teachers in tier-II cities and districts like Tiruchirappalli. Furthermore, the relationship between organizational commitment and teacher retention remains under-researched in this locality. There is also limited literature that combines both identification of commitment factors and their direct influence on teacher retention.

This study attempts to bridge these gaps by offering a localized and comprehensive examination of the variables affecting organizational commitment and its implications on retention among school teachers in Tiruchirappalli.

Statement of the Problem

The growing concern over teacher attrition and declining job satisfaction among school teachers in Tiruchirappalli district has raised questions about the underlying organizational factors that influence their commitment levels. While administrators and policymakers have introduced various reforms, the persistent problem of retaining skilled and motivated teachers continues to affect educational quality.

This research investigates what organizational factors are influencing school teachers' commitment in Tiruchirappalli and how this commitment translates into their decision to remain in the profession. The findings will provide valuable insights for school managements and education authorities to formulate strategies aimed at improving teacher retention through enhanced organizational practices.

Objectives of the Study

To identify the factors that contribute to organizational commitment among school teachers in Tiruchirappalli district. To explore the impact of organizational commitment on teacher retention in Tiruchirappalli district.

Hypotheses of the Study

Based on the review of literature and research objectives, the following hypotheses are formulated:

- H₁: There is a significant relationship between job satisfaction and organizational commitment among school teachers.
- H₂: There is a significant relationship between leadership style and organizational commitment among school teachers.
- H₃: Organizational commitment significantly influences teacher retention in Tiruchirappalli district.
- H₄: There is no significant difference in organizational commitment between teachers working in government and private schools in Tiruchirappalli District.

Research Methodology

Research Design

The study adopts a descriptive and analytical research design to examine the factors influencing organizational commitment and its impact on teacher retention.

Area of Study

The study is confined to Tiruchirappalli District, Tamil Nadu, covering both government and private schools.

Sampling Technique

A stratified random sampling technique is used to ensure representation from different school types (government, aided, private).

Sample Size

A total of 300 school teachers from various schools in Tiruchirappalli district will be surveyed.

Data Collection Method

Data will be collected using a structured questionnaire, designed to capture:

- > Demographic details
- > Factors influencing organizational commitment

- Teacher retention intentions
- The questionnaire will include Likert scale items for quantitative analysis.

Tools for Analysis

Data will be analyzed using:

- Descriptive Statistics (Mean, SD, Percentage)
- Correlation Analysis
- ➤ Multiple Regression Analysis
- Oneway ANOVA

Conceptual Framework

The conceptual framework for the study is built upon the premise that organizational commitment is influenced by multiple organizational factors, and in turn, it significantly affects teacher retention.

Data Analysis and Interpretation

Table 1: Demographic Profile of the Respondents

Variable	Category	Frequency (n)	Percentage (%)	
Gender	Male	152	39.4%	
Gender	Female	234	60.6%	
	Below 30	85	22.0%	
A and (im vicema)	31–40	146	37.8%	
Age (in years)	41–50	98	25.4%	
	Above 50	57	14.8%	
	D.T.Ed. / D.El.Ed.	61	15.8%	
Educational Qualification	B.Ed.	129	33.4%	
Educational Qualification	B.Ed. + PG	102	26.4%	
	M.Ed. / M.Phil. / Ph.D.	94	24.4%	
	Below 5 years	62	16.1%	
Taaahina Eymanianaa	6–10 years	134	34.7%	
Teaching Experience	11–20 years	121	31.3%	
	Above 20 years	69	17.9%	
	Below 20,000	88	22.8%	
Monthly Income (7)	₹20,001–40,000	143	37.0%	
Monthly Income (₹)	₹40,001–60,000	103	26.7%	
	Above ₹60,000	52	13.5%	
Notine of Joh	Permanent	249	64.5%	
Nature of Job	Temporary	137	35.5%	
T f C -11	Government	193	50.0%	
Type of School	Private	193	50.0%	

The demographic profile of the respondents provides a comprehensive view of the composition of school teachers in Tiruchirappalli District. Among the 386 respondents surveyed, a majority were female teachers (60.6%), while male teachers constituted 39.4%. This aligns with the general trend observed in the teaching profession, where female representation is relatively high, particularly at the school level.

With regard to age distribution, the largest proportion of teachers (37.8%) belonged to the 31–40 years age group, followed by 25.4% in the 41–50 years range. About 22.0% of the respondents were aged below 30 years, indicating a steady influx of young professionals into the teaching sector, while 14.8% were aged above 50, representing the experienced senior cadre of teachers nearing retirement age.

Educational qualifications were categorized based on relevance to school-level teaching. It was observed that 33.4% of the teachers held a Bachelor of Education (B.Ed.), which is the standard qualification for teaching at the secondary level. A notable 26.4% had acquired both B.Ed. and postgraduate degrees, making them eligible to teach higher secondary classes. Additionally, 24.4% of the teachers possessed advanced qualifications such as M.Ed., M.Phil., or Ph.D., reflecting their commitment to academic excellence and professional growth. Furthermore, 15.8% of the respondents had completed Diploma in Teacher Education (D.T.Ed./D.El.Ed.), qualifying them for primary school teaching roles.

In terms of teaching experience, 34.7% of respondents had 6–10 years of service, followed closely by 31.3% who had 11–20 years of experience. Teachers with less than 5 years of experience accounted for 16.1%, while 17.9% had served more than 20 years, indicating a balanced mix of novice, mid-career, and experienced teachers in the sample.

When analyzing income levels, the largest group (37.0%) reported a monthly income between ₹20,001 and ₹40,000, while 26.7% earned between ₹40,001 and ₹60,000. About 22.8% of the teachers earned less than ₹20,000, and only 13.5% reported a monthly income above ₹60,000. These figures suggest that the majority of teachers fall within the middle-income bracket, with notable variations depending on school type and experience.

Regarding employment nature, 64.5% of the respondents were permanent employees, indicating job stability and long-term association with their institutions. The remaining 35.5% were engaged in temporary or contract-based roles, which is common in many private institutions and some government schemes.

Interestingly, the study ensured an equal representation of school types, with 50% of the respondents from government schools and the other 50% from private schools. This balanced sample allows for meaningful comparisons between institutional types, especially in relation to organizational commitment and teacher retention.

Hypothesis 1:

Null Hypothesis (H₀): There is no significant relationship between Job Satisfaction and Organizational Commitment among school teachers in Tiruchirappalli District.

Alternative Hypothesis (H₁): There is a significant relationship between Job Satisfaction and Organizational Commitment among school teachers in Tiruchirappalli District.

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Model Summary	Value
R	0.417
R Square (R ²)	0.174
Adjusted R Square	0.172
Standard Error of Estimate	0.650
F-statistic	80.83
Sig. (p-value)	0.000

Table 2: Regression Analysis for Job Satisfaction and Organizational Commitment

The model summary presents the overall strength of the relationship between job satisfaction and organizational commitment among school teachers. The R value of 0.417 indicates a moderate positive correlation between the two variables. The R Square value ($R^2 = 0.174$) reveals that 17.4% of the variance in organizational commitment can be explained by job satisfaction alone. This suggests that job satisfaction plays a notable role in influencing the level of organizational commitment. The F-statistic value of 80.83 with a significance level (p-value) of 0.000 confirms that the regression model is statistically significant. Therefore, the model is a good fit for predicting organizational commitment based on job satisfaction.

Table 3: Coefficients of Regression

Predictor	Unstandardized Coefficient (B)	Standard Error	t-value	Sig. (p-value)	Result
(Constant)	1.254	0.197	6.37	0.000	Significant
Job Satisfaction	0.2906	0.027	10.79	0.000	Significant

The coefficients table provides detailed insight into the effect of job satisfaction on organizational commitment. The unstandardized coefficient (B) for job satisfaction is 0.2906, indicating that for every one-unit increase in job satisfaction, the level of organizational commitment increases by approximately 0.29 units, assuming all other factors remain constant. The associated t-value of 10.79 and p-value of 0.000 signify that this effect is statistically significant at the 1% level. The constant value (intercept) is 1.254, which represents the baseline level of organizational commitment when job satisfaction is at zero (hypothetically). Overall, the results show that job satisfaction is a significant positive predictor of organizational commitment among school teachers in Tiruchirappalli District. Based on the model summary and regression coefficients, Hypothesis 1 is accepted, confirming that job satisfaction has a significant positive impact on organizational commitment.

Hypothesis 2:

Null Hypothesis (H₀): There is no significant difference in organizational commitment among teachers with different levels of work environment.

Alternative Hypothesis (H₁): There is a significant difference in organizational commitment among teachers with different levels of work environment.

Table 4: Oneway ANOVA

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
Between Groups	12.742	2	6.371		
Within Groups	216.350	383	0.565	11.25	0.000
Total	229.092	385			

To examine whether organizational commitment differs based on levels of work environment, a One-Way ANOVA was performed. The results reveal a statistically significant difference in organizational commitment among the three groups of teachers classified by their work environment perception (F = 11.25, p = 0.000). The p-value of 0.000 is less than the standard alpha level of 0.05, which leads to the rejection of the null hypothesis.

This finding suggests that the level of work environment whether perceived as low, medium, or high has a significant impact on organizational commitment. Teachers experiencing a more favorable work environment tend to report higher levels of commitment to their organization. Therefore, Hypothesis 2 is accepted based on the ANOVA result.

Hypothesis 3:

Null Hypothesis (H_0): There is no significant difference in teacher retention across different levels of organizational commitment. Alternative Hypothesis (H_1): There is a significant difference in teacher retention across different levels of organizational commitment.

Table 5: Oneway ANOVA

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	Sig. (p-value)
Between Groups	15.430	2	7.715		
Within Groups	180.233	383	0.471	16.32	0.000
Total	195.663	385			

To examine whether teacher retention levels differ significantly across organizational commitment categories, a One-Way ANOVA test was conducted. The analysis revealed a statistically significant difference in teacher retention based on levels of organizational commitment, F(2, 383) = 16.32, p = 0.000. Since the p-value is less than 0.05, we reject the null hypothesis.

This result indicates that school teachers' retention intent significantly varies with their level of organizational commitment. In other words, those with higher organizational commitment tend to show higher intentions to stay in their current schools compared to those with low commitment.

Therefore, the alternative hypothesis is accepted, and it can be concluded that organizational commitment significantly influences teacher retention among school teachers in Tiruchirappalli District.

Hypothesis 4:

Null Hypothesis (H₀): There is no significant difference in organizational commitment between teachers working in government and private schools in Tiruchirappalli District.

Alternative Hypothesis (H₁): There is a significant difference in organizational commitment between teachers working in government and private schools in Tiruchirappalli District.

Table 6: Descriptive Table

Group	N	Mean Organizational Commitment	Std. Deviation
Government	193	3.68	0.45
Private	193	3.42	0.52

An independent samples t-test was performed to compare the organizational commitment of teachers working in government and private schools in Tiruchirappalli District. The analysis showed that government school teachers (M = 3.68, SD = 0.45) reported significantly higher levels of organizational commitment than their private school counterparts (M = 3.42, SD = 0.52).

Table 7: Independent sample t Test

t-test for Equality of Means	t	df	Sig. (2-tailed)	Mean Difference	Result
Equal variances assumed	4.52	384	0.000	0.26	Significant

Levene's Test indicated that the assumption of equal variances was met (p = 0.129), so equal variance t-test results were used. The t-value = 4.52 and p = 0.000 (< 0.05) indicate that the difference in means is statistically significant.

Thus, the null hypothesis is rejected, and Hypothesis 4 is accepted. This suggests that the type of institution (government or private) significantly influences the level of organizational commitment among school teachers.

Findings of the Study

The present study examined the various factors influencing organizational commitment among school teachers in Tiruchirappalli District and explored how this commitment affects teacher retention. Data were collected from a sample of 386 respondents representing both government and private schools, encompassing a wide range of demographic profiles. The analysis employed various statistical tools, including descriptive statistics, regression analysis, t-tests, and one-way ANOVA, to test the formulated hypotheses and draw meaningful conclusions.

Demographic Profile of the Respondents:

- The analysis of the demographic characteristics revealed that the teaching workforce in Tiruchirappalli is diverse in terms of age, qualification, experience, and nature of employment. Female teachers constituted the majority (60.6%), while male teachers accounted for 39.4%, reflecting the gender composition typical in the school teaching profession. In terms of age, 33.7% of respondents were aged between 31–40 years, followed by 26.2% aged 41–50 years, indicating a predominantly mid-career teaching population.
- ❖ With regard to educational qualifications, a significant proportion of teachers held professional teaching degrees. About 33.4% had a B.Ed., 26.4% had B.Ed. with a PG degree, and 24.4% possessed advanced qualifications such as M.Ed., M.Phil.,

- or Ph.D., suggesting a well-qualified respondent pool. Teaching experience was also diverse, with 34.7% having 6–10 years of experience and 31.3% with 11–20 years of service, showing a balanced mix of both early and experienced educators.
- ❖ Income analysis showed that 37% of teachers earned ₹20,001-₹40,000 per month, placing most respondents in the middle-income category. Further, 64.5% of teachers were in permanent positions, and the rest (35.5%) were in temporary or contractual employment. Lastly, the sample was evenly split between government and private school teachers (50% each), enabling comparative insights.

Hypothesis Testing and Analytical Findings:

- ❖ Hypothesis 1 examined the relationship between job satisfaction and organizational commitment. The regression analysis yielded an R value of 0.417 and R² = 0.174, indicating that job satisfaction explains 17.4% of the variance in organizational commitment. The regression coefficient for job satisfaction was significant (B = 0.2906, p = 0.000), confirming that job satisfaction positively influences organizational commitment. Hence, Hypothesis 1 was accepted, highlighting job satisfaction as a significant predictor of teacher commitment.
- ❖ Hypothesis 2 tested whether organizational commitment differs based on the work environment using one-way ANOVA. The analysis showed a statistically significant difference in organizational commitment across different levels of work environment (F = 11.25, p = 0.000). Teachers who perceived a more favorable work environment reported higher commitment levels. Thus, Hypothesis 2 was accepted, confirming that the work environment significantly impacts organizational commitment.
- ❖ Hypothesis 3 explored whether teacher retention varies with levels of organizational commitment. One-way ANOVA results indicated a significant difference (F = 16.32, p = 0.000), showing that teachers with higher commitment levels were more likely to stay in their positions. Therefore, Hypothesis 3 was accepted, suggesting that increasing organizational commitment can positively influence teacher retention.
- ❖ Hypothesis 4 investigated whether organizational commitment varies between government and private school teachers. The independent samples t-test showed a statistically significant difference (t = 4.52, p = 0.000), with government school teachers (M = 3.68) exhibiting higher organizational commitment than their private school counterparts (M = 3.42). Hence, Hypothesis 4 was accepted, emphasizing the influence of school type on organizational commitment.

Suggestions

Based on the results and findings of the study, the following actionable suggestions are offered to enhance organizational commitment and improve teacher retention among school teachers in Tiruchirappalli District:

- Since job satisfaction was found to have a significant impact on organizational commitment, school management particularly in private institutions should develop programs that recognize teachers' contributions, provide emotional and academic support, and encourage involvement in decision-making processes.
- Teachers who perceived a favorable work environment showed higher levels of organizational commitment. School administrators should focus on improving collegial relationships, reducing workplace stress, and ensuring fair distribution of workload. Providing adequate infrastructure, teaching aids, and a safe, respectful environment is essential.
- Encouraging continuous learning through workshops, seminars, and sponsored educational programs can strengthen commitment. Professional growth not only enhances competency but also builds a stronger emotional connection with the institution.
- ❖ Teachers with higher organizational commitment showed greater intent to stay in their schools. Therefore, school leaders should implement retention strategies that include career advancement opportunities, mentoring for new teachers, transparent communication, and building a culture of trust and belonging.
- The study found that government school teachers exhibited higher organizational commitment compared to private school teachers. Hence, private schools should consider improving job security, pay structures, leave benefits, and timely promotions to retain qualified and experienced teaching staff.
- With a majority of the teaching workforce being female, policies that support work-life balance, maternity benefits, and flexible work arrangements will foster a stronger sense of loyalty and reduce turnover.
- Temporary and contract teachers often feel excluded from institutional culture. Including them in team-building activities, staff meetings, and training programs can make them feel valued and increase their level of commitment.

Conclusion

The present study aimed to identify the factors contributing to organizational commitment among school teachers and to examine how this commitment influences teacher retention in Tiruchirappalli District. The findings clearly indicate that job satisfaction, work environment, and type of school significantly impact organizational commitment. Moreover, organizational commitment plays a crucial role in retaining teachers within their institutions.

Statistical analyses including regression and ANOVA established that teachers who were satisfied with their jobs, experienced supportive work environments, and worked in government schools displayed higher levels of organizational commitment. Furthermore, teachers with high organizational commitment expressed a stronger intention to stay in their current roles, highlighting the commitment-retention link.

The demographic data enriched the analysis by showing that most teachers were professionally qualified, experienced, and working in permanent positions. These characteristics were essential in understanding how different groups perceive their organizational environment and shaped the interpretation of the statistical results.

In conclusion, this research underscores the importance of strategic human resource practices in schools, particularly focusing on improving job satisfaction, creating positive work environments, and reducing disparities between government and private institutions. These initiatives will not only strengthen teacher commitment but also help in addressing the growing concern of teacher attrition, thereby ensuring continuity, stability, and quality in the education system.

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References

- 1. Allen, N. J., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. Journal of Occupational Psychology, 63(1), 1–18. https://doi.org/10.1111/j.2044-8325.1990.tb00506.x
- 2. Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. Review of Educational Research, 78(3), 367–409. https://doi.org/10.3102/0034654308321455
- 3. Ingersoll, R. M. (2001). *Teacher turnover and teacher shortages: An organizational analysis*. American Educational Research Journal, 38(3), 499–534. https://doi.org/10.3102/00028312038003499
- 4. Meyer, J. P., & Allen, N. J. (1997). Commitment in the workplace: Theory, research, and application. SAGE Publications.
- 5. Robbins, S. P., & Judge, T. A. (2019). Organizational behavior (18th ed.). Pearson Education.
- 6. Singh, K., & Billingsley, B. S. (1996). Intent to stay in teaching: Teachers of students with emotional disorders versus other special educators. Remedial and Special Education, 17(1), 37–47. https://doi.org/10.1177/074193259601700106
- 7. Tamil Nadu School Education Department. (2023). Annual Report on Teacher Statistics in Tamil Nadu. Retrieved from https://www.tnschools.gov.in/
- 8. Tett, R. P., & Meyer, J. P. (1993). *Job satisfaction, organizational commitment, turnover intention, and turnover: Path analyses based on meta-analytic findings*. Personnel Psychology, 46(2), 259–293. https://doi.org/10.1111/j.1744-6570.1993.tb00874.x
- 9. Vandenberghe, C., & Bentein, K. (2009). A closer look at the relationship between affective commitment to supervisors and organizations and turnover. Journal of Occupational and Organizational Psychology, 82(2), 331–348. https://doi.org/10.1348/096317908X312641
- 10. Yücel, I. (2012). Examining the relationships among job satisfaction, organizational commitment, and turnover intention: An empirical study. International Journal of Business and Management, 7(20), 44–58. https://doi.org/10.5539/ijbm.v7n20p44

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