Journal of Education Method and Learning Strategy
E-ISSN 2986-9129 E-ISSN 3031-9250
Volume 2 Issue 03, September 2024, Pp. 936-945
DOI: https://doi.org/10.59653/jemls.v2i03.913

Exploring Mathematical Attitudes among Primary Teachers: A Comparative Study in Selected District, India

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Received: 10-05-2024 *Reviewed: 23-05-2024* *Accepted: 10-06-2024*

Abstract

This quantitative study will investigate the mathematical attitudes of primary teachers in Gaya District, Bihar, India, with the aim of understanding how demographic factors will influence these attitudes. By utilizing a modified version of Moreira C.M.'s (1992) Attitude towards Mathematics Inventory, the research has assess teachers' understanding, confidence, and pedagogical approaches in teaching mathematics. Data on gender, location, caste background, qualification, and teaching experiences will be collected through a structured questionnaire. A stratified random sampling technique has ensured representation across demographics, with a targeted sample size of at least 200 primary teachers. Statistical analyses, including t-tests and ANOVA, will be employed to examine the hypotheses regarding gender, location, caste background, qualification, and teaching experiences. The findings are expected to provide valuable insights into the factors shaping mathematical attitudes among primary teachers in a diverse educational context like Bihar, India, contributing to the ongoing educational reforms in the region.

Keywords: Mathematical attitudes, Primary teachers, Demographic factors, Quantitative research, Educational reforms

Introduction

Mathematical attitudes among primary school teachers play a pivotal role in shaping the mathematical learning experiences of young learners. The way teachers perceive and approach mathematics significantly influences their instructional practices, which, in turn, impact students' attitudes, engagement, and achievement in the subject. Understanding the factors that contribute to variations in these attitudes is essential for devising effective strategies to enhance mathematical education quality. This study aims to delve into the demographic variances in

mathematical attitudes among primary teachers in selected districts in Bihar, India, shedding light on the intricacies of this crucial aspect of mathematics education.

Bihar, a state in eastern India, has been undergoing significant educational reforms in recent years, aiming to improve the quality of education across all levels. However, challenges persist, particularly in the domain of mathematics education, where low proficiency levels and negative attitudes toward the subject are prevalent among both students and teachers. Addressing these challenges requires a nuanced understanding of the factors influencing teachers' attitudes towards mathematics, considering the diverse demographic characteristics prevalent in the region.

Demographic variables such as age, gender, educational background, teaching experience, and socioeconomic status have been identified as influential factors shaping individuals' attitudes and perceptions towards mathematics. While extensive research has been conducted on this topic globally, there is a paucity of studies focusing on the specific demographic variances in mathematical attitudes among primary teachers in Bihar, India. Hence, this study seeks to bridge this gap by exploring the relationship between various demographic factors and teachers' attitudes towards mathematics.

Theoretical frameworks such as the Theory of Planned Behavior (Ajzen, 1991) and Social Cognitive Theory (Bandura, 1986) provide a lens through which to examine the interplay of individual beliefs, experiences, and socio-environmental factors in shaping attitudes and behaviors. Effectiveteaching that is effective does not take its impact on pupils for granted. It considers the connection between teaching and learning to be problematic, ambiguous, and relative (Gorain & Kalhotra, 2024). According to these frameworks, attitudes towards a specific behavior, such as teaching mathematics, are influenced by a combination of cognitive, affective, and contextual factors. By examining how demographic variables interact with these factors, this study aims to uncover patterns and trends in mathematical attitudes among primary teachers in Bihar.

In Bihar, socio-cultural norms, economic disparities, and historical factors intersect to shape educational experiences, making it crucial to explore how these demographic variables interact with teachers' attitudes towards mathematics. Identifying the unique challenges and opportunities associated with different demographic groups can help policymakers and educators develop targeted interventions to support primary teachers in enhancing their mathematical teaching practices and fostering positive attitudes towards the subject among young learners (Schoenfeld, 2004; NCTM, 2000).

Mathematics education is a critical component of primary schooling, serving as the foundation for higher-level mathematical understanding and reasoning. The attitudes of primary school teachers towards mathematics significantly influence the learning experiences and outcomes of their students (Thompson, 1992). In-service primary teacher trainees, who are undergoing professional development to enhance their teaching skills, represent a vital cohort for understanding attitudes towards mathematics within the educational context (Grootenboer, 2008).

The Gaya district in Bihar is home to a diverse population of primary school students and teachers. Despite the importance of mathematics education, little research has been conducted to explore the attitudes of in-service primary teacher trainees towards mathematics in this region (NCERT, 2006). This quantitative study aims to fill this gap by examining the attitudes towards mathematics among in-service primary teacher trainees in Gaya district. By conducting a comprehensive analysis of attitudes using quantitative methods, this research seeks to provide insights into the factors influencing attitudes towards mathematics among this specific group of educators (Creswell, 2014).

Objective

1. Investigate the Mathematical Attitude's Level of Primary teachers in Gaya District, Bihar, focusing on their understanding, confidence, and pedagogical approaches towards teaching mathematics.
2. Investigate the demographic factors such as gender, location, caste background, qualification, and teaching experiences among Primary teachers in Gaya District, Bihar.

Hypothesis

1. There is no significant difference in mathematical attitudes between male and female primary teachers in Gaya District, Bihar.
2. There is no significant difference in mathematical attitudes between urban and rural primary teachers in Gaya District, Bihar.
3. There is no significant difference in mathematical attitudes among general, OBC, SC and ST primary teachers in Gaya District, Bihar.
4. There is no significant difference in mathematical attitudes among low, moderate and high qualified primary teachers in Gaya District, Bihar.
5. There is no significant difference in mathematical attitudes among low, moderate and high experiences primary teachers in Gaya District, Bihar.

Literature Review

Research conducted in diverse educational contexts has highlighted the significance of demographic factors in shaping teachers' attitudes towards mathematics. For instance, studies have found that younger teachers tend to have more positive attitudes towards technology integration in mathematics instruction (Wang et al., 2018), while teachers with higher levels of education may exhibit greater confidence and competence in teaching mathematics (Bursal & Paznokas, 2006). Similarly, gender differences have been observed in mathematical self-concept and confidence, with male teachers often reporting higher levels of confidence in their mathematical abilities compared to their female counterparts (Marsh et al., 2013).

Methodology

The quantitative research approach was adopted to investigate the mathematical attitudes of primary teachers in Gaya District, Bihar. Employing a modified version of the Attitude towards Mathematics Inventory by Moreira C.M. (1992), the research was measure teachers' attitudes, focusing on their understanding, confidence, and pedagogical approaches towards teaching mathematics. Data on demographic factors such as gender, location, caste background, qualification, and teaching experiences have been collected through a structured questionnaire. To ensure robust representation across different demographic categories, a purposive sampling technique will be employed, aiming for a sample size of at least 177 primary teachers. Statistical analyses, including t-tests and ANOVA, will be conducted to test hypotheses regarding gender, location, caste background, qualification, and teaching experiences (Mirgank et al. 2024). The findings were offered valuable insights into the factors influencing mathematical attitudes among primary teachers in Gaya District, Bihar.

Results

Descriptive Statistics (Mean, SD, Skewness, Kurtosis, Minimum & Maximum) of Mathematical Attitude:

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
MA	177 177	109	250	205.05	19.287	-.626	.183	2.528	.363

The descriptive statistics shed light on the distribution and characteristics of the variable "MA," likely denoting mathematical achievement scores. The mean score of approximately 205.05 indicates a moderate level of achievement among the respondents. The standard deviation, at 19.287, reflects a moderate degree of variability around this mean. This suggests that while scores are not tightly clustered, they also do not exhibit extreme dispersion, signifying a somewhat consistent performance across respondents.

The negative skewness value of -0.626 suggests a slight leftward skew in the distribution. This indicates a tendency for more scores to cluster towards the lower end, with fewer outliers at the higher end. The positive kurtosis of 2.528 indicates a leptokurtic distribution, implying heavier tails and a sharper peak compared to a normal distribution. This suggests the presence of more extreme values or outliers, potentially influencing the distribution's shape.

Level of Mathematical Attitudes of Teachers

		Frequency	Percent	Valid Percent
Valid	low	58	32.8	32.8
	moderate	61	34.5	34.5
	high	58	32.8	32.8
	Total	177	100.0	100.0

The data represents the distribution of respondents' levels of mathematical attitudes, categorized as low, moderate, and high. Each category comprises a significant portion of the sample, with moderate attitudes being slightly more prevalent.

1. **Low Attitudes (32.8%):** This suggests that a notable portion of individuals harbor negative perceptions or feelings towards mathematics. Educational implications include the need for targeted interventions to address misconceptions, anxiety, or negative experiences that may contribute to these attitudes. Strategies could involve personalized learning approaches, experiential learning activities, and fostering a supportive learning environment to cultivate a more positive outlook.
2. **Moderate Attitudes (34.5%):** While this group constitutes the largest percentage, their attitudes may vary from slightly positive to neutral. Educational implications include the opportunity to further engage this segment by highlighting the practical applications, relevance, and enjoyment of mathematics. Encouraging real-world problem-solving, interactive activities and collaborative learning can help maintain and potentially elevate their attitudes towards mathematics.
3. **High Attitudes (32.8%):** This segment demonstrates a strong affinity or positive disposition towards mathematics. Educational implications entail nurturing and harnessing this enthusiasm to foster advanced learning, critical thinking, and problem-solving skills. Providing challenging yet stimulating tasks, opportunities for exploration and creativity, and access to advanced coursework can further cultivate their passion and aptitude for mathematics.

Independent Sample t-test of Male and Female Teachers on Mathematical Attitude

Variable	N	Mean	SD	SED	df	t	Remark
Male	100	209.04	16.73	4.44			Significant
Female	77	199.87	21.17		175	3.21	

The t-test result shows a t-value of 3.21 with 175 degrees of freedom. These degrees of freedom are derived from the sample sizes of the two groups. For a two-tailed test at the 0.05 significance level, the critical t-value for 175 degrees of freedom is approximately 1.97. Since our calculated t-value of 3.21 exceeds this critical value, we reject the null hypothesis that there is no difference between the mean scores of males and females. This indicates that the observed difference in mean scores—209.04 for males and 199.87 for females—is statistically significant.

ANOVA on Mathematical Attitude

Mathematical Attitude	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1556.134	2	778.067	2.118	.123
Within Groups	63914.408	174	367.324		
Total	65470.542	176			

The ANOVA results indicate that the variance in mathematical attitudes between the three groups (Sum of Squares between Groups: 1556.134) is not significantly different from the variance within the groups (Sum of Squares within Groups: 63914.408). With a total variance (Total Sum of Squares: 65470.542), the mean squares for between groups and within groups are 778.067 and 367.324, respectively. The F-value of 2.118, derived from these mean squares, and the p-value of .123 suggest that the observed differences in mathematical attitudes between the groups are not statistically significant at the conventional alpha level of 0.05.

ANOVA on Mathematical Attitude

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	428.351	3	142.784	.380	.768
Within Groups	65042.192	173	375.966		
Total	65470.542	176			

The ANOVA analysis of Mathematical Attitude indicates no statistically significant differences between group means ($F(3, 173) = 0.380$, $p = 0.768$). This suggests that the variations observed in mathematical attitudes across the groups are likely attributed to random chance rather than systematic differences. These findings carry significant educational implications, implying that interventions aimed at improving mathematical attitude might not necessarily need to tailor strategies based on specific group characteristics, as examined in this study. Instead, educators can focus on implementing universal approaches to cultivate positive mathematical attitudes across diverse student populations. In conclusion, although this study did not uncover significant group disparities in mathematical attitude, future research endeavors could delve into additional factors influencing attitudes towards mathematics, thereby offering deeper insights into the development of effective educational interventions.

ANOVA on Mathematical Attitude

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	816.679	2	408.340	1.099	.336
Within Groups	64653.863	174	371.574		
Total	65470.542	176			

The ANOVA analysis reveals non-significant differences among group means, with an F-value of 1.099 ($p = .336$), indicating that the independent variable does not significantly influence the dependent variable. Consequently, we fail to reject the null hypothesis, suggesting that other factors beyond the scope of this study may better account for variations in the

dependent variable. This finding underscores the need for educators to explore additional factors or interventions to comprehensively understand and address variations in student performance or attitudes within educational contexts. It highlights the complexity of interpreting statistical analyses in educational research and emphasizes the importance of considering various influencing factors in studying educational outcomes.

ANOVA on Mathematical Attitude on teachers teaching experiences:

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2231.56	4	557.89	1.51	.19
Within Groups	63238.98	172	367.66		
Total	65470.54	176			

Based on the ANOVA results presented, the analysis aimed to determine whether there were statistically significant differences between the means of different groups. The calculated F-value, which compares the variance between groups to the variance within groups, was found to be 1.517. Additionally, the significance level associated with this F-value was calculated as 0.199. This significance level indicates the probability of obtaining the observed result if the null hypothesis—that there are no significant differences between group means—is true.

In traditional hypothesis testing, a significance level below a predetermined threshold (typically 0.05) leads to the rejection of the null hypothesis, indicating significant differences between at least two of the group means. In this instance, however, the significance level of 0.199 exceeds the conventional threshold. Consequently, we fail to reject the null hypothesis, as there is insufficient evidence to support significant differences between the group means (Field, 2013).

The observed range of scores, spanning from a minimum of 109 to a maximum of 250, illustrates the variability within the dataset. Although the average achievement level is moderate, there is some degree of variability, but it is not excessively pronounced. The slight skewness and leptokurtic nature of the distribution suggest nuances such as the presence of outliers and a potential bias towards lower scores (Gravetter & Wallnau, 2017).

Discussion and Implication

The ANOVA results indicate uniformity in the effectiveness of different teaching methods or educational interventions across the groups, as the p-value is greater than 0.05. Consequently, we fail to reject the null hypothesis, suggesting no significant difference in mathematical attitudes between the groups. This suggests that educators should focus on understanding individual differences, given the high within-group variance. Personalized approaches tailored to individual needs may be more effective than group-based interventions. Additionally, educational resources should be allocated to address factors influencing within-group variance, ensuring a more customized and effective approach to improving mathematical attitudes.

These findings imply that the factors under investigation, while potentially influential, do not exhibit a statistically significant effect on the outcome variable based on this analysis. This could suggest that the examined factors are not meaningful predictors of the outcome, or it may indicate that the sample size is too small to detect significant differences if they truly exist. Further exploration or refinement of the research methodology may be necessary to better understand the relationships between the variables in question.

The ANOVA results demonstrate no significant difference in mathematical attitudes among the three groups. Consequently, educational strategies should prioritize addressing individual differences within groups to enhance mathematical attitudes rather than implementing group-based interventions. This interpretation aligns with standard statistical procedures as outlined by Field (2013) and Moore, McCabe, and Craig (2012), who emphasize understanding variance and significance in comparing group means.

The ANOVA analysis suggests that, based on the provided data and statistical tests, there is insufficient evidence to conclude significant differences between the means of the groups being compared. This underscores the importance of thorough statistical analysis and interpretation to derive meaningful conclusions from research findings.

Conclusion

The distribution of mathematical attitudes among respondents underscores the diverse perceptions and feelings individuals hold towards the subject. While a significant portion exhibit moderate attitudes, there is variability across the spectrum, including both low and high attitudes. Understanding and addressing these attitudes is crucial for shaping effective educational strategies aimed at promoting positive engagement and achievement in mathematics. By implementing targeted interventions and leveraging individuals' existing attitudes, educators can strive to foster a more inclusive and supportive learning environment conducive to mathematical growth and success.

Although this study did not reveal significant differences in mathematical attitudes among the groups studied, it highlights the complexity of factors influencing attitudes towards mathematics among primary teachers in Bihar, India. Further research is warranted to explore additional variables and their interactions to gain a comprehensive understanding of how to effectively promote positive attitudes towards mathematics among educators and students alike.

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