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Professional Competencies of Teachers and Students' Academic Performance: A Study of Primary Education in Rural Odisha

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Abstract: ***This study investigates the professional competencies of primary school teachers in rural Odisha and their influence on student academic performance. In the context of growing concerns over declining learning outcomes despite rising enrolment, the study highlights the critical role of teacher quality in delivering effective education. Drawing on a mixed-methods approach, data were collected from 200 primary school teachers across four rural districts through structured questionnaires and classroom observations. The analysis employed descriptive statistics, factor analysis, and multiple regression models to assess core competencies such as pedagogical knowledge, classroom management, subject expertise, and digital literacy. Findings reveal substantial variation in teacher competencies, with significant skill gaps in digital fluency and continuous professional development, particularly in tribal and under-resourced areas. Regression results indicate a strong positive relationship between teacher competencies and student achievement scores in mathematics and language, confirming the hypothesis that better-prepared teachers contribute to improved educational outcomes. The study underscore the need for competency-based teacher evaluation systems and targeted interventions, including localized training models and digital literacy programs. The paper concludes with policy recommendations to strengthen teacher training frameworks and align educational strategies with the unique challenges of rural Odisha.***

Keywords: Teacher Competency, Primary Education, Rural Odisha, Student Achievement, Teacher Training, Educational Quality

1. Introduction

Primary education forms the foundation of a child's learning journey and significantly influences their cognitive, emotional, and social development (UNESCO, 2015). In India, the importance of primary education is enshrined in both the Constitution and various national education policies. The Right of Children to Free and Compulsory Education Act, 2009, mandates quality education for all children aged 6 to 14. Despite substantial investments in educational infrastructure and increased enrolment rates, learning outcomes in many rural areas remain suboptimal (ASER, 2022).

In states like Odisha, particularly in its rural and tribal districts, several systemic challenges affect primary education. These include infrastructural deficits, socio-economic disparities, language barriers, and the unavailability of trained teachers (MHRD, 2019). Odisha has over 36,000 government-run primary schools, serving nearly 5.3 million children at the elementary level (UDISE+, 2021-22). However, dropout rates remain concerning, particularly in tribal districts, where the dropout rate at the primary level is as high as 5.42% compared to the national average of 1.5% (NIEPA, 2022). Additionally, the Pupil-Teacher Ratio (PTR) in many rural areas exceeds the prescribed norm of 30:1, with certain districts recording PTRs above 40:1. According to the National Achievement Survey (NAS) 2021, only 54% of students in Grade 5 in Odisha demonstrated age-appropriate competencies in mathematics and language, highlighting persistent learning gaps.

Among the several contributing factors, the professional competency of primary school teachers stands out as a critical determinant of educational quality. Teachers in rural areas often work in multi-grade classrooms with minimal support, which amplifies the importance of their skills and adaptability. Professional competencies refer to a combination of knowledge, skills, attitudes, and values that enable teachers to perform effectively. These include pedagogical techniques, subject knowledge, classroom management, communication skills, and the ability to integrate and adapt to educational technologies. As emphasized by Darling-Hammond (2000), teacher quality is one of the strongest predictors of student achievement. Similarly, studies by Rivkin et al. (2005) and Kingdon (2007) assert that the competencies of teachers have a more profound effect on learning outcomes than other school-level factors.

In the context of Odisha, where socio-economic and geographical challenges persist, evaluating and improving teacher competencies is essential. Previous research has shown that many rural teachers lack adequate training, access to resources, and ongoing professional development opportunities (Patnaik, 2015; Mishra & Nayak, 2018). Furthermore, with the increasing emphasis on digital education and competency-based learning, rural teachers are under pressure to develop new skill sets to remain effective in the classroom.

2. Review of Literature

The concept of teacher competency has been extensively studied both in global and Indian contexts. According to Shulman (1987), effective teaching hinges on a teacher's pedagogical content knowledge, which includes not just mastery over subject matter but also the ability to convey it in ways that are comprehensible to students. Darling-Hammond (2000) posits that teacher preparation, continuous

professional development, and working conditions all contribute significantly to teacher effectiveness.

In India, several studies have highlighted gaps in teacher quality and the challenges in professional development. The National Council for Teacher Education (NCTE) outlines essential professional competencies under various domains, including content mastery, pedagogy, and professional ethics. Kingdon and Banerji (2009) emphasize the variation in teacher quality and its significant impact on student achievement, particularly in low-income rural settings. Muralidharan and Sundararaman (2010) conducted randomized evaluations in Andhra Pradesh that underscored how teacher incentives based on student performance can improve learning outcomes.

Specific to Odisha, Patnaik (2015) analyzed the status of teacher training and found a significant disconnect between pre-service training and classroom realities, especially in tribal regions. Similarly, Mishra and Nayak (2018) documented that a large proportion of primary school teachers in rural Odisha lacked digital skills, despite the increasing use of technology in education delivery. International assessments, such as PISA and TIMSS, provide a broader framework for understanding teacher competencies and learning outcomes. Hattie (2003) consolidates meta-analyses to argue that teacher-related factors have the largest impact on student learning, even more than socioeconomic status or school infrastructure.

Despite these findings, there is limited empirical literature specifically examining the correlation between professional competencies and student performance in rural Odisha. This paper aims to explore the current status of professional competencies among primary school teachers in rural Odisha and examine how these competencies influence student academic outcomes. By employing a mixed-method approach and robust statistical tools, the study provides empirical insights that can inform policy and practice. It also seeks to bridge the research gap by contributing quantitative evidence on the correlation between teacher competencies and learning achievements in under-researched rural settings.

3. Objectives

1) To assess the current level of professional competencies among primary school teachers in rural Odisha.
2) To examine the relationship between teacher competencies and student academic performance.
3) To suggest policy measures for improving teacher competencies and learning outcomes in rural areas.

4. Methodology

This study adopts a mixed-methods approach, combining both quantitative and qualitative techniques to comprehensively assess the professional competencies of primary school teachers in rural Odisha. The methodology is designed to collect empirical data on teacher skills, classroom practices, and their impact on student learning outcomes. The study utilizes surveys, classroom observations, and econometric modelling to analyze the relationship between teacher competencies and student performance.

Research Design

The research follows a descriptive and analytical design. Descriptive analysis is used to assess the status of teacher competencies, while analytical methods, including statistical models, are applied to examine the relationships between teacher competencies and student outcomes. The study is conducted across four rural districts of Odisha: Ganjam, Kalahandi, Koraput, and Rayagada, selected based on their significant representation of rural and tribal populations.

Sample Selection

The study targets primary school teachers in rural Odisha. A stratified random sampling method is used to select a sample of 200 teachers. The teachers are selected from government-run primary schools, ensuring diversity in terms of experience, education level, and exposure to professional development programs. The sample includes teachers who are currently teaching in grades 1 through 5, as these grades are pivotal in the early stages of primary education. The student sample consists of 1,000 students from the same schools, with a focus on students from Grade 5, as this grade is commonly used to assess the learning outcomes in national surveys like the National Achievement Survey (NAS).

Data Collection Tools

Teacher Competency Survey: A structured questionnaire is developed to assess various competencies of teachers, including pedagogical knowledge, classroom management skills, subject expertise, digital literacy, and ability to handle diverse classroom settings. The survey also includes questions related to teacher training, professional development opportunities, and personal perceptions of teaching effectiveness.

- Classroom Observations: Classroom observations are conducted using a standardized observation checklist to assess teaching practices in real-time. Observers note the use of different teaching strategies, student engagement, classroom management, and the integration of digital tools.
- Student Performance Tests: Standardized tests in mathematics, language, and science are administered to the students to measure their academic performance. These tests are aligned with the learning outcomes specified by the National Curriculum Framework (NCF) for primary education.
- Interviews and Focus Group Discussions (FGDs): Qualitative data is collected through semi-structured interviews with a subset of 30 teachers and focus group discussions with students. These interviews and discussions aim to understand the challenges teachers face in the classroom, their perceptions of professional development programs, and how they feel about the integration of digital tools into teaching.

Data Analysis Techniques

Quantitative data collected through surveys and student performance tests is analyzed using the following methods:

a) Descriptive Statistics: Measures such as mean, median, and standard deviation is used to summarize the teacher competencies and student performance levels.
b) Factor Analysis: This technique is employed to identify key dimensions of teacher competencies based on the survey responses. Factor analysis helps in grouping

related competencies into factors, such as pedagogical skills, subject knowledge, and digital literacy.

c) Regression Analysis: To quantify the impact of different dimensions of teacher competencies on student academic performance, the following multiple linear regression models are used.

Let:

- Ymath : Student performance score in Mathematics (dependent variable)
- Ylang: Student performance score in Language (dependent variable)
- X1: Pedagogical Competence Score
- X2: Subject Knowledge Score
- X3: Classroom Management Score
- X4: Digital Literacy Score
- ϵ: Error term

Model 1: Impact on Mathematics Achievement

$$Ymath=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\epsilon$$

Model 2: Impact on Language Achievement

$$Ylang=\alpha0+\alpha1X1+\alpha2X2+\alpha3X3+\alpha4X4+\epsilon$$

Where:

- $\beta0$, $\alpha0$: Intercepts of the respective models
- βi, αi: Regression coefficients representing the marginal effect of each competency domain on the respective academic outcome
- ϵ: Random error capturing unobserved factors affecting student outcomes

T-tests and ANOVA is used to compare the competencies of teachers across different demographic variables such as teaching experience, educational qualifications, and exposure to training programs.

5. Results and Discussion

This section presents the results of the analysis of teacher competencies in rural Odisha, as outlined in the methodology. And tries to find out the relationship between teachers competencies and students' academic performance of primary school students The data collected from the Teacher Competency Survey, classroom observations, and student performance tests are analyzed using descriptive statistics, factor analysis, and reliability testing. The findings are discussed in relation to the objective of assessing the current level of professional competencies among primary school teachers.

Competencies Assessment of Teachers

The first objective of the study was to assess the current level of professional competencies among primary school teachers in rural Odisha. Table 1 presents the mean competency scores across different domains: Pedagogical Competence, Subject Knowledge, Classroom Management, and Digital Literacy. The responses were measured on a 5-point Likert scale (1 = No Competence, 5 = High Competence).

Table 1: Mean Competency Scores of Teachers Across Domains

Competency Domain	Mean Score	Standard Deviation
Pedagogical Competence	3.42	0.87
Subject Knowledge	3.56	0.92
Classroom Management	3.28	1.05
Digital Literacy	2.91	1.23

Source: Compiled by the author

From the table, it is observed that the mean competency scores for Pedagogical Competence and Subject Knowledge are relatively higher (around 3.4 and 3.6), suggesting that teachers generally possess a moderate level of competency in these areas. However, Classroom Management and Digital Literacy have lower scores, particularly Digital Literacy (mean = 2.91), indicating a significant gap in this area.

Factor Analysis of Teacher Competencies

To identify underlying factors related to teacher competencies, a factor analysis was conducted. The results revealed that the competencies loaded onto three main factors: Pedagogical Skills, Subject Knowledge, and Technology Integration.

Table 2: Factor Loadings from Factor Analysis of Teacher Competencies

Competency Item	Pedagogical Skills	Subject Knowledge	Technology Integration
Ability to design lesson plans	0.79		
Use of active learning strategies	0.84		
Mastery over subject content		0.82	
Classroom management techniques	0.75		
Ability to integrate digital tools			0.81
Use of multimedia in teaching			0.78

Source: Compiled by the author

Factor loadings above 0.7 indicate strong associations between items and factors. Pedagogical Skills was the dominant factor, with items related to lesson planning, active learning strategies, and classroom management showing strong loadings. Subject Knowledge loaded onto items reflecting mastery of subject content. Technology Integration was the third factor, reflecting teachers' ability to use digital tools and multimedia in the classroom.

Comparative Analysis of Teacher Competencies

Further analysis using t-tests and ANOVA is conducted to explore whether teacher characteristics (such as years of experience, education level, and professional development participation) influenced competency levels.

Table 3: T-test Results for Teacher Competency by Years of Experience

Competency Domain	Less than 5 years	More than 5 years	t-value
Pedagogical Competence	3.30	3.55	-1.62
Subject Knowledge	3.42	3.63	-1.35
Classroom Management	3.08	3.48	-2.56
Digital Literacy	2.75	3.10	-2.14

Source: Compiled by the author

The t-test results show that teachers with more than 5 years of experience perform significantly better in Classroom Management ($p = 0.011$) and Digital Literacy ($p = 0.034$) compared to those with less than 5 years of experience. However, there are no significant differences in Pedagogical Competence and Subject Knowledge based on years of experience.

Table 4: ANOVA Results for Teacher Competency by Education Level

Competency Domain	Graduate	Post-Graduate	F-value
Pedagogical Competence	3.45	3.58	0.75
Subject Knowledge	3.50	3.60	1.12
Classroom Management	3.22	3.34	0.42
Digital Literacy	2.92	3.12	1.98

Source: Compiled by the author

The ANOVA results suggest that there are no significant differences in competencies based on education level (graduate vs. post-graduate) across the domains tested. This implies that, in the sample studied, the educational qualifications did not significantly impact teacher competencies in areas like classroom management, subject knowledge, or digital literacy.

The results suggest several important insights regarding teacher competencies in rural Odisha. Teachers in rural Odisha demonstrate moderate competencies in pedagogical skills and subject knowledge, which are crucial for effective teaching. This reflects the adequacy of basic teacher preparation but highlights areas for further improvement, especially in adapting to diverse student needs. Teachers reported relatively lower competencies in classroom management, which is consistent with findings from previous studies in rural India (Patnaik, 2015). Effective classroom management is essential, especially in multigrade classrooms typical of rural areas, where students have varied academic levels and behavioral challenges. The low mean score for digital literacy (2.91) is concerning, given the growing emphasis on digital education. This indicates that while teachers are somewhat familiar with digital tools, there is a clear need for professional development in this area to enhance teaching effectiveness. Teachers with more than 5 years of experience show better competency in classroom management and digital literacy, which suggests that experience plays a significant role in developing these skills. However, this study did not find significant differences in pedagogical competence or subject knowledge based on experience, indicating that these competencies may be more dependent on formal teacher training rather than years of service. The ANOVA results indicate no significant difference in teacher competencies based on education level (graduate vs. post-graduate). This finding suggests that additional academic qualifications may not necessarily translate into improved teaching skills in rural areas, possibly due to the lack of practical training in addressing the unique challenges of rural classrooms.

In conclusion, the results reveal that while teachers in rural Odisha exhibit moderate competencies in core areas, there are notable gaps, especially in classroom management and digital literacy. The study highlights the need for targeted interventions, such as professional development programs focusing on classroom management strategies and the integration of digital tools. Furthermore, the findings suggest that experience plays a role in improving certain competencies, while formal education does not appear to be a significant factor. These insights can inform policies aimed at enhancing teacher training and support in rural settings.

Relationship between Teacher Competencies and Student Academic Outcomes

This section presents the results and discussion related to the second objective of the study: examining the relationship between teacher competencies and student academic outcomes in rural Odisha. To achieve this, the study utilized multiple regression models to understand how different competencies (pedagogical skills, subject knowledge, classroom management, and digital literacy) relate to student performance in mathematics and language assessments.

Student Academic Outcomes

Before analyzing the relationship between teacher competencies and student outcomes, Table 5 presents the descriptive statistics for student performance in Mathematics and Language assessments. The scores for each subject were normalized on a 100-point scale.

Table 5: Student Academic Outcomes

Subject	Mean Score	Standard Deviation	Minimum Score
Mathematics	56.23	18.43	22
Language	61.18	15.68	30

Source: Compiled by the author

From the table, it is observed that the average student performance in both subjects is moderately low, with a mean score of 56.23 in mathematics and 61.18 in language. The standard deviations indicate considerable variation in student performance, suggesting that the academic outcomes of students are uneven across the sample.

Teacher Competencies and Student Academic Outcomes

To examine the relationship between teacher competencies and student academic outcomes, multiple regression analysis is conducted. The dependent variables are student mathematics scores and student language scores, while the independent variables are the competencies of teachers in Pedagogical Skills, Subject Knowledge, Classroom Management, and Digital Literacy.

Table 6: Multiple Regression Results for Student Mathematics Scores

Competency Domain	Unstandardized Coefficients	Standardized Coefficients (β)
Pedagogical Competence	2.35	0.34
Subject Knowledge	1.56	0.23
Classroom Management	0.94	0.15
Digital Literacy	0.12	0.04
R^2		0.365
Adjusted R^2		0.354

Source: Compiled by the author

Table 7: Multiple Regression Results for Student Language Scores

Competency Domain	Unstandardized Coefficients	Standardized Coefficients (β)
Pedagogical Competence	1.92	0.31
Subject Knowledge	2.34	0.29
Classroom Management	0.74	0.12
Digital Literacy	0.18	0.07
R^2		0.389
Adjusted R^2		0.378

Source: Compiled by the author

The regression results in Table 6 show that Pedagogical Competence (β = 0.34) and Subject Knowledge (β = 0.23) are statistically significant predictors of student performance in mathematics, with p-values less than 0.05. The higher the teachers' competency in pedagogy and subject knowledge, the better the students tend to perform in mathematics. The classroom management competency also has a positive effect on mathematics scores, though it is not statistically significant (p = 0.088). This suggests that while classroom management might influence learning outcomes, it may not be as strong a predictor as pedagogical skills and subject knowledge in rural settings. The Digital Literacy competency was not found to significantly impact student mathematics scores (p = 0.471). This suggests that while digital tools are becoming increasingly important, they may not yet be a primary factor influencing student performance in mathematics in rural Odisha.

In Table 7, Pedagogical Competence (β = 0.31) and Subject Knowledge (β = 0.29) again emerge as significant predictors of student language scores, with p-values below 0.05. These findings suggest that teachers who are competent in pedagogical strategies and have strong subject knowledge are more likely to improve student outcomes in language. While Classroom Management (β = 0.12) and Digital Literacy (β = 0.07) have positive coefficients, they are not statistically significant for language scores (p-values of 0.124 and 0.268, respectively). This further reinforces the notion that while these factors may have some impact on student learning, they are less critical compared to pedagogical competence and subject knowledge in influencing language learning outcomes.

The results from the regression analysis reveal that pedagogical competence and subject knowledge are the strongest predictors of student academic outcomes in rural Odisha, both in mathematics and language. These findings are consistent with prior research that emphasizes the central role of teaching quality, especially in foundational subject knowledge and effective teaching methods, in enhancing student performance (Darling-Hammond, 2000; Rivkin et al., 2005). The relatively weaker role of classroom management in student outcomes in this study, compared to other studies (Patnaik, 2015), might be attributed to the fact that most teachers in rural Odisha face common classroom challenges such as multi-grade classrooms, large class sizes, and limited resources. Effective classroom management techniques may require further training and a better support system, which could explain why it shows a weaker relationship with student outcomes. The lack of a significant relationship between digital literacy and student outcomes may reflect the current reality in rural schools where digital tools and technology are often underutilized due to infrastructural constraints or a lack of teacher training in integrating technology into lessons. Despite the increasing emphasis on digital literacy in educational policies, the impact on student learning outcomes might be more pronounced in future studies, once teachers in rural areas become more proficient in using digital tools.

6. Conclusion

The study set out to assess the current level of professional competencies among primary school teachers in rural Odisha and examine how these competencies influence student academic performance. The findings from surveys, classroom observations, and statistical analyses offer several key insights. First, while many teachers exhibit basic pedagogical and subject knowledge, significant gaps remain in classroom management skills, assessment practices, and digital literacy. These deficiencies are more pronounced in tribal and remote areas, where teachers often work in multi-grade environments with limited support. The factor analysis revealed that competencies in pedagogy and subject knowledge loaded most heavily as principal components, suggesting these remain the core strengths. However, digital competency and continuous learning were less developed across the sample. Second, regression models confirmed a statistically significant positive relationship between teacher competencies and student academic outcomes, particularly in mathematics and language learning. Teachers with higher pedagogical and subject-specific skills consistently supported better student performance.

7. Policy Recommendations

1) Introduce regular, modular training programs focused on core competencies such as pedagogy, classroom management, and digital literacy, tailored to rural teaching contexts.
2) Establish continuous teacher performance evaluation systems linked to classroom observations and student outcomes, enabling data-driven professional development.
3) Equip rural schools with basic digital infrastructure and provide targeted digital literacy programs for teachers to integrate technology effectively in the classroom.
4) Introduce performance-based incentives and recognition for teachers demonstrating exceptional competencies and improvements in student learning outcomes.

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