PILOT STUDY ON PERSONALITY PROFILES (CLUSTERS), GENDER, AND STUDENT ENGAGEMENT OUTCOMES IN PURBA MEDINIPUR DISTRICT OF WEST BENGAL

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Abstract

This pilot study investigates the relationship between teacher personality profiles, gender, and student engagement outcomes in higher secondary science classrooms in Purba Medinipur District, West Bengal. Recognizing the influence of personality on instructional practices, the study focuses on how teacher traits, particularly openness to experience and extraversion, relate to the adoption of interactive and inquiry-based teaching methods. A mixed-methods approach was employed, combining quantitative surveys with qualitative classroom observations. Forty science teachers participated, completing a validated Five-Factor Model

personality inventory, while 200 students completed a structured engagement survey. Classroom observations assessed the use of real-life examples, student participation, lesson flexibility, and promotion of problem-solving.

Cluster analysis revealed three distinct teacher personality profiles: Cluster A (high openness and extraversion, n = 12), Cluster B (moderate scores across traits, n = 18), and Cluster C (low openness and extraversion, n = 10). Descriptive statistics indicated that students of Cluster A teachers had the highest engagement scores (M = 81.2, SD = 4.8), followed by Cluster B (M = 73.5, SD = 5.9) and Cluster C (M = 66.1, SD = 6.2). Gender differences were minor, with female teachers slightly more represented in Cluster A; however, t-tests showed no statistically significant differences in student engagement scores based on teacher gender. Correlation analysis revealed a moderate positive relationship between openness and student engagement (r = 0.56, p < 0.01), and regression analysis confirmed that personality clusters significantly predicted engagement outcomes ($R^2 = 0.34$, $F(2,37) = 9.56$, $p < 0.001$).

Qualitative observations supported these findings, showing that high-openness teachers actively used real-life examples, encouraged discussions, adapted lessons flexibly, and promoted problem-solving. Moderate-openness teachers combined structured instruction with some participatory elements, while low-openness teachers followed rigid lesson plans with limited student interaction.

The study confirms the feasibility of the instruments and methods and highlights the importance of teacher personality in shaping engagement. Findings emphasize the need for professional development programs that cultivate openness, adaptability, and student-centered practices to enhance inquiry-based science teaching in rural contexts.

1.0 Introduction

Personality plays a critical role in influencing teaching practices, classroom interactions, and ultimately, student outcomes. Among personality traits, openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability (as identified in the Five-Factor Model) have been linked to instructional strategies and engagement outcomes (McCrae & Costa, 1997). In classroom settings, teachers' personalities influence how they communicate with students, adapt lessons, and encourage participation. This study focuses on the clustering of teacher personality profiles and investigates how these profiles, along with gender, are associated with student engagement outcomes in higher secondary science classrooms in Purba Medinipur District of West Bengal.

Student engagement—behavioral, emotional, and cognitive—is recognized as a key determinant of academic success and lifelong learning (Fredricks, Blumenfeld, & Paris, 2004). Inquiry-based teaching, collaborative activities, and real-world examples are strategies that facilitate engagement. However, the adoption of such strategies may vary according to teachers' personality profiles and gender, especially in rural districts where educational resources and exposure to contemporary pedagogical methods may be limited. Understanding the

intersection of teacher personality clusters, gender, and student engagement can inform teacher training and professional development programs tailored to local needs.

This pilot study aims to examine the relationship between personality clusters of teachers, gender differences, and student engagement outcomes. It seeks to test the feasibility of research instruments, refine data collection procedures, and provide preliminary findings that can guide a larger-scale study in similar rural contexts.

1.1 Statement of the Problem

Effective science teaching depends not only on curriculum and resources but also on teacher characteristics, including personality traits. In rural districts like Purba Medinipur, the extent to which teacher personality influences student engagement remains underexplored. While openness to experience and extraversion are believed to promote interactive, inquiry-based teaching, their impact alongside gender differences on student engagement has not been systematically studied. This pilot study investigates how teacher personality profiles, clustered based on trait combinations, and gender relate to student engagement outcomes in higher secondary science classrooms, providing preliminary insights for larger-scale research. **Pilot Study on Personality Profiles (Clusters), Gender, and Student Engagement Outcomes in Purba Medinipur District of West Bengal**

2. Review of Related Literature

2.1 Teacher Personality and Instructional Practices

The Five-Factor Model (McCrae & Costa, 1997) provides a framework for understanding how personality traits influence teaching. Openness to experience correlates with creativity, flexibility, and willingness to adopt student-centered approaches, while conscientiousness is linked to organization, lesson planning, and reliability. Extraverted teachers are more likely to engage students actively, and agreeableness fosters supportive interactions.

Research demonstrates that personality clusters—distinct combinations of traits—may better predict instructional approaches than individual traits (O'Connor & Paunonen, 2007). Teachers with high openness and extraversion clusters tend to employ inquiry-based and participatory methods, whereas teachers low in openness may favor structured, teacher-centered approaches.

2.2 Gender Differences in Teaching Practices

Studies indicate that gender may influence teaching styles, although findings are mixed. Some research suggests female teachers adopt more collaborative, student-centered approaches, while male teachers may rely more on structured instruction (Eagly & Wood, 2012). However, personality traits often mediate these gender effects, suggesting that gender alone is not a strong predictor of teaching behavior.

2.3 Student Engagement

Student engagement encompasses behavioral (participation in activities), emotional (interest, motivation), and cognitive (deep processing, reflection) dimensions (Fredricks et al., 2004). Teachers' personality traits, such as openness and extraversion, influence student engagement through their ability to make lessons interactive, encourage discussion, and respond to student curiosity.

2.4 Research Gaps

- Limited studies explore teacher personality clusters in rural Indian contexts.
- Few studies examine the combined influence of teacher personality profiles and gender on student engagement outcomes.
- Pilot studies are lacking that test instrument feasibility and preliminary patterns linking personality clusters to engagement.

3. Rationale for the Pilot Study

The pilot study serves as a critical preparatory step for investigating the relationship between teacher personality profiles, gender, and student engagement outcomes in higher secondary science classrooms of Purba Medinipur District, West Bengal. First, it is essential to test the feasibility of the research instruments in a rural educational context. The study employed a Five-Factor Model personality inventory and a structured student engagement survey, along with a classroom observation rubric. Preliminary data from 40 teachers indicated that the personality inventory produced scores ranging from 52 to 81 for openness, with a mean of 68.5 (SD = 7.2), while student engagement scores for 200 students ranged from 55 to 89, with a mean of 74.3 (SD = 8.2). These results suggest that the instruments are practical, reliable, and understandable in the local context, making them suitable for a larger-scale study.

Second, the pilot study provides an opportunity to identify preliminary patterns linking personality clusters to student engagement outcomes. Cluster analysis of the 40 participating teachers revealed three distinct personality profiles: Cluster A (high openness & extraversion, n = 12), Cluster B (moderate scores across traits, n = 18), and Cluster C (low openness & extraversion, n = 10). Initial findings showed that students taught by Cluster A teachers had the highest engagement scores (Mean = 81.2, SD = 4.8), followed by Cluster B (Mean = 73.5, SD = 5.9) and Cluster C (Mean = 66.1, SD = 6.2). These trends suggest a meaningful association between teacher personality traits and classroom engagement, supporting the relevance of further investigation.

Third, the study aims to examine the potential moderating role of gender in these relationships. While female teachers were slightly more represented in Cluster A (7 out of 12) and male teachers were evenly distributed across clusters, t-tests revealed no statistically significant differences in student engagement scores between male and female teachers' classes (t = -0.57, p = 0.57). This finding indicates that gender may have a minor

role compared to personality traits, but the pilot provides essential data to refine analyses for a larger-scale study.

Additionally, the pilot study allows for the refinement of sampling procedures, observation schedules, and data collection techniques. Field notes indicated that three classroom observations per teacher were sufficient to capture instructional behaviors, and minor adjustments were made to the timing and rubric scoring to ensure reliability. Finally, the study provides preliminary estimates of effect sizes and variability, such as the moderate correlation between openness and student engagement ($r = 0.56$, $p < 0.01$), which can inform sample size calculations and statistical planning for future research.

Overall, this pilot study establishes the feasibility and utility of the research instruments, identifies preliminary patterns linking personality traits to student engagement, and refines methodology, laying a solid foundation for a larger-scale investigation.

4. Objectives of the Study

1. To identify teacher personality profiles (clusters) using the Five-Factor Model.
2. To examine gender differences in teacher personality clusters.
3. To explore the relationship between teacher personality clusters and student engagement outcomes.
4. To assess the feasibility of the instruments and research methodology for a full-scale study.

5. Methodology of the Study

5.1 Research Design

A mixed-methods pilot study was conducted, combining quantitative surveys with qualitative classroom observations.

5.2 Participants

The study included 40 higher secondary science teachers from government and private schools in Purba Medinipur District (20 male, 20 female). A total of 200 students from these classes were also assessed for engagement outcomes.

5.3 Instruments

1. **Personality Inventory:** A validated Five-Factor Model questionnaire assessing openness, conscientiousness, extraversion, agreeableness, and emotional stability.
2. **Student Engagement Survey:** A scale measuring behavioral, emotional, and cognitive engagement.
3. **Classroom Observation Rubric:** Structured checklist to assess inquiry-based and participatory teaching strategies.

5.4 Procedure

Teachers completed the personality inventory. Classroom observations were conducted over three sessions per teacher. Student engagement surveys were administered at the end of the observed lessons. Data were anonymized, coded, and analysed for patterns and relationships.

5.5 Data Analysis

- Descriptive statistics to summarize personality scores and student engagement.
- Cluster analysis to identify personality profiles.
- Independent samples t-tests to examine gender differences.
- Correlation and regression analyses to explore relationships between personality clusters and engagement outcomes.
- Qualitative analysis of field notes to supplement quantitative findings.

6. Analysis and Interpretation of Collected Data

6.1 Descriptive Statistics

Variable	N	Mean	SD	Min	Max
Openness to Experience	40	68.5	7.2	52	81
Conscientiousness	40	71.2	6.8	55	82
Extraversion	40	64.7	8.1	50	79
Agreeableness	40	70.5	6.4	58	80
Emotional Stability	40	66.3	7.0	52	78
Student Engagement Score	200	74.3	8.2	55	89

Interpretation:

- Teachers scored moderately high on openness, conscientiousness, and agreeableness, indicating potential for inquiry-based and student-centered teaching.
- Student engagement scores were moderately high, reflecting generally active classroom participation.

6.2 Cluster Analysis

Cluster analysis identified three distinct teacher personality profiles based on openness and extraversion scores:

Cluster	Description	N	Mean Openness	SD Openness	Mean Extraversion	SD Extraversion
A	High Openness & Extraversion	12	78.4	2.9	76.2	3.1
B	Moderate Scores across Traits	18	68.0	3.6	65.4	4.2
C	Low Openness & Extraversion	10	58.7	3.0	55.9	2.8

Interpretation:

- **Cluster A** teachers demonstrate high creativity, flexibility, and willingness to engage students actively. These teachers are likely to implement inquiry-based teaching practices.
- **Cluster B** teachers show balanced personality traits, combining structured instruction with some degree of student-centered activities.
- **Cluster C** teachers exhibit lower openness and extraversion, preferring traditional, teacher-centered approaches with minimal student interaction.
- The spread of scores indicates meaningful variability in teacher personality profiles in the sample.

6.3 Gender Differences

Distribution of teachers across clusters by gender:

Cluster	Male	Female	Total
A	5	7	12
B	9	9	18
C	6	4	10
Total	20	20	40

Interpretation:

- Female teachers were slightly more represented in Cluster A (high openness & extraversion).
- Male teachers were evenly distributed across Clusters B and C.

Independent Samples t-test for Student Engagement by Gender:

Gender	N	Mean Engagement	SD	t	p
Male	20	73.8	8.1	-0.57	0.57
Female	20	74.8	8.4		

Interpretation:

- The slight differences in mean student engagement scores between male and female teachers' classes are **not statistically significant**.
- Gender alone does not predict engagement outcomes, although it may interact with personality traits.

6.4 Correlation and Regression Analysis

Correlation between Openness and Student Engagement:

Variable	Student Engagement	r	p
Openness Score	Student Engagement	0.56	0.001

Interpretation:

- A **moderate positive correlation** exists, indicating that higher openness is associated with higher student engagement.

Regression Analysis Predicting Student Engagement from Personality Cluster and Gender:

Predictor	B	SE B	β	t	p
Constant	55.2	4.8	-	11.5	0.000
Cluster (coded 1–3)	5.8	1.9	0.51	3.05	0.004
Gender (Male=0, Female=1)	1.1	1.8	0.10	0.61	0.544

Model Summary:

- $R^2 = 0.34$, $F(2,37) = 9.56$, $p < 0.001$

Interpretation:

- Personality cluster significantly predicts student engagement, accounting for 34% of variance.
- Gender is not a significant predictor, confirming that personality traits exert more influence on engagement outcomes than gender.

- Teachers in Cluster A are associated with the highest levels of student engagement, followed by Cluster B, with Cluster C showing the lowest engagement outcomes.

Main Findings

1. Three distinct personality clusters were identified, showing meaningful differences in openness and extraversion among teachers.
2. Female teachers were slightly more represented in the high-openness/extraversion cluster, but gender differences in student engagement were minor and not statistically significant.
3. Openness is positively correlated with student engagement ($r = 0.56$, $p < 0.01$).
4. Regression analysis confirms that personality cluster is a significant predictor of student engagement ($R^2 = 0.34$), while gender does not significantly contribute.
5. High-openness/extraversion teachers (Cluster A) consistently promoted interactive, inquiry-based learning and higher student engagement.

6.5 Qualitative Observations

Classroom observations were coded using a structured rubric evaluating four key dimensions: **Use of Real-Life Examples (RLE), Student Participation (SP), Lesson Flexibility (LF), and Problem-Solving Promotion (PSP)**. Each dimension was rated on a 5-point scale (1 = very low, 5 = very high). The mean scores for teachers in each personality cluster were tabulated below:

Cluster	N	RLE (Mean ± SD)	SP (Mean ± SD)	LF (Mean ± SD)	PSP (Mean ± SD)
High Openness (A)	12	4.6 ± 0.5	4.5 ± 0.6	4.7 ± 0.4	4.5 ± 0.5
Moderate Openness (B)	18	3.3 ± 0.7	3.4 ± 0.6	3.1 ± 0.7	3.2 ± 0.6
Low Openness (C)	10	2.1 ± 0.5	2.0 ± 0.6	2.3 ± 0.5	2.1 ± 0.4

Interpretation:

1. **Use of Real-Life Examples (RLE):**
   - Teachers in Cluster A consistently integrated real-world examples into lessons, linking abstract concepts to students' daily experiences. This approach enhanced comprehension and engagement.
   - Cluster B teachers occasionally used real-life examples but primarily relied on textbook content.
   - Cluster C teachers rarely used practical examples, relying heavily on rote explanations.
2. **Student Participation (SP):**
   - High-openness teachers encouraged discussions, peer responses, and collaborative problem-solving, resulting in high engagement scores.

- o Moderate-openness teachers permitted some interaction but maintained teacher-centered control, limiting active student participation.
- o Low-openness teachers provided minimal opportunities for discussion, with students mostly listening passively.

3. **Lesson Flexibility (LF):**
   - o Cluster A teachers adapted lessons dynamically based on student questions and feedback, demonstrating significant flexibility.
   - o Cluster B teachers occasionally adjusted lesson flow but primarily followed pre-planned structures.
   - o Cluster C teachers rigidly adhered to lesson plans, showing little adaptability.

4. **Problem-Solving Promotion (PSP):**
   - o High-openness teachers actively promoted critical thinking and problem-solving, encouraging students to explore multiple solutions.
   - o Moderate-openness teachers incorporated limited problem-solving exercises.
   - o Low-openness teachers focused on memorization and step-by-step instruction, rarely fostering analytical thinking.

Analysis:

- The qualitative ratings strongly reinforce the quantitative cluster findings, showing that personality traits, particularly openness and extraversion, significantly influence teaching behavior and classroom practices.
- High-openness teachers created interactive, inquiry-based environments that aligned with best practices in science education, fostering higher student engagement and deeper understanding.
- Moderate-openness teachers serve as transitional models, blending traditional instruction with occasional interactive elements, suggesting potential for improvement through targeted professional development.
- Low-openness teachers' reliance on structured, rote methods may limit student engagement and problem-solving skill development, highlighting areas for intervention.

Findings Summary:

1. **High-openness teachers** (Cluster A) excel in using real-life examples, promoting discussions, adapting lessons flexibly, and encouraging problem-solving.
2. **Moderate-openness teachers** (Cluster B) balance structured teaching with limited participatory elements, providing moderate student engagement.
3. **Low-openness teachers** (Cluster C) maintain rigid lesson plans, minimize interaction, and emphasize rote learning, leading to low engagement.

4. These qualitative observations corroborate the numerical cluster analysis, emphasizing that **teacher personality traits are a key determinant of instructional style and student engagement**, while gender differences remain secondary.

7. Discussion

The findings of this pilot study provide compelling evidence that teacher personality profiles, particularly high levels of openness and extraversion, are significant predictors of student engagement in higher secondary science classrooms. Teachers in Cluster A, characterized by high openness and extraversion, consistently created learning environments that were dynamic, interactive, and inquiry-driven. They employed real-life examples, encouraged student discussion, adapted lessons in response to student needs, and promoted problem-solving and critical thinking. These practices directly facilitated higher levels of behavioral, emotional, and cognitive engagement among students. In contrast, teachers with moderate or low openness demonstrated more structured, teacher-centered approaches, with correspondingly lower student engagement outcomes.

Gender differences, while present, were relatively minor and did not emerge as significant predictors of either instructional methods or student engagement outcomes. Female teachers were slightly more represented in the high-openness cluster, and they occasionally favored collaborative approaches, but overall, gender did not significantly influence engagement scores. This suggests that individual personality traits, rather than demographic factors, are the primary drivers of pedagogical style and student participation. This finding aligns with existing literature emphasizing the greater predictive power of teacher personality over gender in determining classroom practices (McCrae & Costa, 1997; O'Connor & Paunonen, 2007).

The combination of quantitative and qualitative data provides a nuanced understanding of how teacher personality shapes classroom dynamics. Cluster analysis, correlation, and regression results indicated that high-openness teachers were more likely to foster engagement, while classroom observations highlighted specific behavioral strategies—such as flexibility, real-world contextualization, and encouragement of multiple student perspectives—that concretely illustrate these statistical trends. This integration of methods underscores the robustness of the relationship between personality traits and engagement outcomes.

In rural contexts like Purba Medinipur, where educational resources may be limited and teacher exposure to contemporary pedagogical approaches can vary, fostering openness and adaptability among teachers is particularly crucial. Professional development programs should focus on cultivating traits and skills associated with high openness, including creativity, adaptive lesson planning, and the ability to facilitate inquiry-based learning. Mentorship, collaborative workshops, and reflective practice can serve as mechanisms to support teachers in developing these capacities, thereby enhancing student engagement and promoting higher-order thinking skills.

Overall, this study emphasizes the centrality of teacher personality traits in shaping effective science instruction. By identifying the behaviors and clusters associated with high engagement, educational stakeholders can better target training interventions, optimize instructional practices, and ultimately improve learning outcomes for students in rural schools.

8. Conclusion

The pilot study confirms that teacher personality clusters, particularly those characterized by high openness and extraversion, exert a significant influence on student engagement in higher secondary science classrooms. Teachers exhibiting these traits were observed to implement more interactive, flexible, and student-centered teaching practices, which directly enhanced behavioral, emotional, and cognitive engagement among students.

While gender differences were noted, their effect on teaching style and student engagement was secondary to personality influences. Female teachers were slightly more represented in high-openness clusters, but quantitative analyses revealed no statistically significant differences in student outcomes between male and female teachers. This underscores the conclusion that personality traits, rather than demographic characteristics, are the primary determinants of classroom instructional approaches.

The pilot study also demonstrates the feasibility of using personality inventories, structured student engagement surveys, and classroom observation rubrics in rural school settings, providing reliable and actionable data for future research. Moreover, the integration of quantitative and qualitative findings highlights specific strategies that high-openness teachers employ, offering practical insights for teacher development.

The study's findings have important implications for teacher training programs. To promote inquiry-based pedagogy and maximize student engagement, professional development should emphasize fostering creativity, adaptability, and flexibility in lesson planning, as well as encouraging active, student-centered learning environments. By targeting these traits, educational stakeholders can enhance the effectiveness of science instruction, improve engagement outcomes, and lay the groundwork for broader educational reforms in rural contexts.

In conclusion, this pilot study not only identifies the key role of teacher personality in shaping engagement but also provides a validated framework for larger-scale investigations. Cultivating openness and extraversion among teachers represents a promising avenue for improving science education and student outcomes in Purba Medinipur and similar rural districts.

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