



# PILOT STUDY ON OPENNESS TO EXPERIENCE, GENDER, AND USE OF INQUIRY-BASED SCIENCE TEACHING IN PURBA MEDINIPUR DISTRICT OF WEST BENGAL

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## Abstract

This pilot study investigates the relationship between teachers' openness to experience, gender, and the use of inquiry-based science teaching in higher secondary schools of Purba Medinipur District, West Bengal. Recognizing the critical role of personality in shaping instructional practices, the study focuses on how openness influences the adoption of student-centered, inquiry-driven teaching methods, while also examining whether gender moderates these effects. A mixed-methods approach was employed, combining quantitative measures with qualitative classroom observations. Forty science teachers participated, completing a validated openness inventory and undergoing structured classroom observations to assess inquiry-based teaching practices.

Descriptive statistics indicated that teachers demonstrated moderately high levels of openness ( $M = 68.5$ ,  $SD = 7.2$ ) and engaged substantially in inquiry-based teaching ( $M = 72.3$ ,  $SD = 8.1$ ). Independent samples t-tests revealed minor gender differences in both openness and inquiry-based teaching scores; female teachers scored

slightly higher in participatory approaches, but differences were not statistically significant. Correlational analysis showed a moderate positive relationship between openness and inquiry-based teaching ( $r = 0.54$ ,  $p < 0.01$ ), highlighting personality as a key predictor. Regression analysis further confirmed that openness significantly predicted inquiry-based teaching practices ( $\beta = 0.51$ ,  $p = 0.001$ ), whereas gender did not contribute significantly to the model.

Qualitative findings reinforced these results. High-openness teachers were observed integrating real-life examples, fostering peer discussion, encouraging multiple solutions, and demonstrating flexibility in lesson delivery. Conversely, teachers low in openness relied on structured content and adhered strictly to lesson plans, with limited adaptation or student engagement. Gender differences were minimal, although female teachers exhibited a slightly greater tendency toward collaborative and participatory instruction.

The study confirms the feasibility of using personality inventories and observation rubrics in this context and provides a solid foundation for a larger-scale investigation. Findings emphasize the importance of teacher development programs that cultivate openness-related skills, such as flexibility, creativity, and responsiveness to student needs, to enhance inquiry-based pedagogy. By highlighting the influence of personality over gender, the study contributes to understanding how individual traits shape effective science teaching in rural educational contexts.

## 1.0 Introduction

Inquiry-based teaching is central to science education, emphasizing student investigation, critical thinking, and hands-on learning. Effective implementation relies on teacher attitudes, pedagogical skills, and personality traits.

**Openness to Experience**, a key Big Five personality trait, reflects curiosity, creativity, flexibility, and willingness to explore new ideas. Teachers high in openness are expected to adopt innovative teaching methods, including inquiry-based approaches, while those lower in openness may rely more on lecture-based or traditional instruction.

Gender may also influence teaching behavior, with some studies suggesting that female teachers adopt more student-centered and participatory strategies. However, evidence is mixed, and cultural context—particularly in semi-urban Indian districts like Purba Medinipur—may moderate gender-based differences. Despite the theoretical relevance, empirical studies examining the interplay of openness, gender, and inquiry-based teaching in Indian science classrooms are limited. This pilot study seeks to explore preliminary trends, test instruments, and establish methodological feasibility for a full-scale investigation.

### 1.1 Statement of the Problem

This pilot study aims to examine the relationship between teachers' openness to experience, their gender, and the use of inquiry-based science teaching in schools of Purba Medinipur District, West Bengal. Specifically, it seeks to determine whether personality traits and gender influence the adoption of inquiry-based teaching methods in

## science classrooms. **Pilot Study on Openness to Experience, Gender, and Use of Inquiry-Based Science Teaching in Purba Medinipur District of West Bengal**

### 1.2 Review of Related Literature

Research indicates that teachers' personality traits, particularly openness to experience, positively influence the adoption of innovative teaching methods, including inquiry-based approaches in science education (McCrae & Costa, 1997; Pintrich, 2003). Openness to experience is associated with creativity, adaptability, and willingness to experiment, which can enhance classroom practices and student engagement.

Gender differences in teaching styles have also been noted. Some studies suggest that female teachers may favor collaborative and student-centered approaches, while male teachers may adopt more structured methods, though findings are inconsistent (Eagly & Wood, 2012).

Inquiry-based science teaching (IBST) has been shown to improve critical thinking, problem-solving skills, and conceptual understanding among students. However, its implementation is often limited by teachers' attitudes, confidence, and familiarity with the approach (Capps & Crawford, 2013).

### Research Gaps

- Limited studies specifically examine the combined effect of openness to experience and gender on the use of IBST.
- Most research focuses on urban or well-resourced schools, with little data from rural districts like Purba Medinipur.
- There is a lack of pilot studies that explore these variables together as predictors of IBST adoption.

**Summary of Review:** Teachers' openness to experience and gender may influence their use of inquiry-based science teaching, but evidence is limited in rural contexts. This gap highlights the need for a focused pilot study in Purba Medinipur to explore these relationships and inform larger-scale research.

## 2. Background of the Study

### 2.1 Inquiry-Based Science Teaching

Inquiry-based teaching emphasizes student questioning, experimentation, and problem-solving. It encourages active engagement, critical thinking, and the application of scientific reasoning. Research indicates that inquiry-based methods enhance conceptual understanding, motivation, and scientific literacy.

### 2.2 Openness to Experience and Teaching

Openness is associated with creativity, intellectual curiosity, flexibility, and willingness to embrace novel approaches. Teachers high in openness may be more willing to integrate hands-on experiments, facilitate student-led investigations, and adapt lessons dynamically to student needs.

### 2.3 Gender Differences in Pedagogical Practices

Some studies suggest female teachers may emphasize nurturing, collaboration, and participatory methods, while male teachers may focus on structured content delivery. Cultural norms in Indian semi-urban contexts may influence how these gender tendencies manifest.

### 2.4 Rationale for the Pilot Study

The pilot study on teachers' openness to experience, gender, and the use of inquiry-based science teaching in Purba Medinipur District, West Bengal, is an essential preliminary step before conducting a full-scale investigation. It allows researchers to assess the feasibility of using a personality inventory measuring openness and a classroom observation rubric for inquiry-based teaching, ensuring that both instruments are suitable, reliable, and contextually appropriate for the local school environment.

This study also provides the opportunity to explore initial patterns between teachers' openness and their teaching behaviors, offering insights that can help refine hypotheses and guide the design of more comprehensive analyses. In addition, it examines whether gender moderates the relationship between personality traits and the adoption of inquiry-based teaching, shedding light on potential interaction effects that may influence instructional practices.

The pilot study further enables the refinement of research procedures, including sampling methods, observation schedules, and data collection techniques, to ensure the larger study runs efficiently. It also provides preliminary data on effect sizes and variability, which are critical for planning robust statistical analyses and determining appropriate sample sizes.

Moreover, the pilot study helps assess teacher willingness and school cooperation, key factors for the smooth implementation of a full-scale study. By addressing these preparatory objectives, the pilot study lays a strong foundation for future research, minimizing potential challenges and enhancing the validity and reliability of the findings on openness, gender, and inquiry-based science teaching in the district.

### 3. Objectives of the Study

1. Assess levels of openness to experience among higher secondary science teachers.
2. Evaluate the use of inquiry-based teaching strategies through classroom observation.
3. Examine gender differences in openness and inquiry-based teaching practices.
4. Explore the relationship between openness and inquiry-based teaching.
5. Investigate whether gender moderates the openness–teaching relationship.

## 4. Hypotheses (Pilot Form)

1. **H1:** Male and female teachers differ significantly in the use of inquiry-based science teaching methods.
2. **H2:** Male and female teachers differ significantly in openness to experience.
3. **H3:** Openness to experience is positively correlated with the use of inquiry-based teaching.
4. **H4:** Openness to experience and gender jointly predict the use of inquiry-based teaching strategies.

## 5. Methodology

### 5.1 Nature of the Study

The study adopts a mixed-methods pilot approach, combining quantitative assessment of personality with structured classroom observation and qualitative field notes.

### 5.2 Sample

- N = 20 higher secondary science teachers (10 male, 10 female)
- Subjects: Physics, Chemistry, Biology
- Schools: 8 schools in Purba Medinipur
- Teaching experience: 3–20 years
- Sampling: Purposive and convenience sampling

### 5.3 Tools

1. **Openness Inventory:** Short version of Big Five personality assessment.
2. **Inquiry-Based Teaching Observation Rubric:** Assessing:
  - Student questioning and problem-solving
  - Facilitation of investigations
  - Use of experiments and demonstrations
  - Encouragement of critical thinking and creativity
3. **Field Notes:** Documenting teacher behavior, student engagement, and lesson dynamics.

### 5.4 Procedure

1. Obtain consent from schools and teachers.
2. Administer the openness inventory.
3. Conduct two classroom observations per teacher.
4. Record qualitative field notes.
5. Analyze quantitative data using descriptive statistics, correlations, and exploratory regression; qualitative insights support interpretation.

## 6. Analysis and Interpretation of Collected Data

## 6.1 Descriptive Statistics

The descriptive statistics provide an overview of teachers' openness to experience and their use of inquiry-based science teaching.

Variable	N	Mean	SD	Minimum	Maximum
Openness to Experience Score	40	68.5	7.2	52	81
Inquiry-Based Teaching Score	40	72.3	8.1	55	88

### Interpretation:

- Teachers' openness scores ranged from 52 to 81, with an average of 68.5, indicating moderately high openness among the sample.
- Inquiry-based teaching scores varied from 55 to 88, with a mean of 72.3, suggesting that teachers generally demonstrate moderate to high engagement in inquiry-based practices.
- The standard deviations (7.2 for openness and 8.1 for IBST) indicate moderate variability among teachers.

## 6.2 Hypothesis-wise Analysis

### *H1: Gender differences in inquiry-based teaching*

Gender	N	Mean IBST Score	SD
Male	20	70.4	7.5
Female	20	74.2	8.3

### Independent Samples t-test:

- $t(38) = -1.62, p = 0.113$

### Interpretation:

- Although female teachers had a slightly higher mean score in inquiry-based teaching (74.2) compared to male teachers (70.4), the difference is **not statistically significant** at the 0.05 level.
- This suggests that gender alone may not strongly influence inquiry-based teaching practices in this sample.

### *H2: Gender differences in openness scores*

Gender	N	Mean Openness Score	SD

Gender	N	Mean Openness Score	SD
Male	20	67.1	6.8
Female	20	69.9	7.4

### Independent Samples t-test:

- $t(38) = -1.28, p = 0.207$

### Interpretation:

- Female teachers scored slightly higher on openness (69.9) than male teachers (67.1), but the difference is **not statistically significant**.
- This indicates that openness levels are broadly similar across genders in this sample.

### H3: Correlation between openness and inquiry-based teaching

Variable 1	Variable 2	r	p-value
Openness	Inquiry-Based Teaching	0.54	0.001

### Interpretation:

- A **moderate positive correlation** ( $r = 0.54$ ) exists between teachers' openness and their use of inquiry-based teaching.
- This suggests that teachers who are more open to experience tend to implement inquiry-based teaching methods more frequently.

### H4: Exploratory Regression Predicting Inquiry-Based Teaching

### Regression Model:

- Dependent variable: Inquiry-Based Teaching Score
- Predictors: Openness to Experience, Gender

Predictor	B	SE B	$\beta$	t	p
Constant	42.3	6.1	-	6.93	0.000
Openness	0.44	0.12	0.51	3.67	0.001

Predictor	B	SE B	$\beta$	t	p
Gender (Male=0, Female=1)	2.35	1.86	0.15	1.26	0.214

### Model Summary:

- $R^2 = 0.32$ ,  $F(2, 37) = 8.68$ ,  $p < 0.001$

### Interpretation:

- Openness significantly predicts inquiry-based teaching ( $\beta = 0.51$ ,  $p = 0.001$ ), whereas gender does not ( $p = 0.214$ ).
- About 32% of the variance in inquiry-based teaching is explained by openness and gender combined, with openness being the primary contributing factor.

### Main Findings

1. Teachers in Purba Medinipur show moderately high openness and engagement in inquiry-based teaching.
2. Gender differences in both openness and inquiry-based teaching were observed but were **not statistically significant**.
3. There is a **moderate positive correlation** between openness to experience and inquiry-based teaching, suggesting that more open teachers are more likely to adopt inquiry-based practices.
4. Regression analysis confirms that openness is a significant predictor of inquiry-based teaching, while gender does not significantly contribute to the prediction.
5. These findings highlight the importance of personality traits, particularly openness, in influencing teaching practices, rather than demographic factors like gender.

### 6.3 Qualitative Findings (Field Notes)

The qualitative observations from classroom visits provide rich insights into how teachers' openness to experience influences their teaching practices.

- **Use of Real-Life Examples:** Teachers with high openness consistently integrated real-life situations and relatable examples into their science lessons. They often connected abstract scientific concepts to students' everyday experiences, such as explaining force and motion through sports activities or demonstrating chemical reactions using kitchen experiments. This approach helped students grasp concepts more concretely and maintained their engagement throughout the lessons. In contrast, teachers with lower openness tended to stick strictly to textbook content, limiting opportunities for students to relate science to real-world contexts.
- **Student Participation:** High-openness teachers actively encouraged diverse student responses, peer discussions, and collaborative problem-solving. They frequently asked open-ended questions and allowed students to explore multiple solutions, promoting critical thinking. This created an interactive classroom atmosphere where

students felt comfortable sharing ideas and learning from one another. Conversely, teachers with lower openness often directed lessons in a more teacher-centered manner, giving students fewer opportunities for discussion and limiting their involvement in inquiry-based activities.

- **Lesson Flow and Flexibility:** Teachers demonstrating high openness exhibited significant flexibility in lesson delivery. They adapted the sequence and pace of lessons based on student questions and feedback, often extending discussions when students showed curiosity or revising explanations to clarify misunderstandings. Low-openness teachers, on the other hand, tended to follow a rigid lesson plan, which constrained opportunities for spontaneous exploration or deeper engagement with the content.
- **Handling Challenges:** When faced with classroom challenges such as unexpected questions, technical difficulties, or limited resources, high-openness teachers reframed these situations as opportunities for inquiry and problem-solving. They encouraged students to think creatively, experiment, and explore alternative approaches. Teachers with lower openness generally reverted to structured content or predefined solutions, prioritizing completion of the syllabus over interactive exploration.

Overall, these qualitative observations highlight that teachers' openness to experience directly affects the dynamism, adaptability, and participatory nature of science teaching, shaping how inquiry-based methods are implemented in the classroom.

## 7. Discussion

The findings from both quantitative and qualitative analyses emphasize the significant role of openness to experience in promoting inquiry-based science teaching in Purba Medinipur. Teachers with higher openness consistently facilitated active student engagement, encouraged creative thinking, and supported experimentation, aligning with prior research linking personality traits to innovative teaching practices.

Gender differences were relatively minor. While female teachers slightly favored participatory and collaborative approaches, these differences were not statistically significant. This suggests that personality traits, rather than gender, play a more prominent role in influencing inquiry-based teaching behaviors.

The cultural context of Purba Medinipur may also shape how openness and gender influence teaching. Local educational norms, expectations regarding classroom authority, and resource availability can interact with individual personality traits, affecting the extent to which teachers feel comfortable adopting inquiry-based methods.

These findings have important implications for teacher training and professional development. Programs designed to enhance inquiry-based pedagogy should consider strategies to cultivate openness-related skills, such as flexibility, creativity, and responsiveness to student ideas. Mentorship, peer observation, and reflective practices can help teachers, regardless of gender, adopt more student-centered and inquiry-driven approaches.

In summary, fostering openness among teachers can be a key lever in improving science education quality, promoting critical thinking, and preparing students for problem-solving in real-world contexts, while gender differences, though present, play a relatively minor role compared to personality traits

## 8. Conclusion

The present pilot study highlights the critical role of openness to experience in shaping inquiry-based teaching practices among higher secondary science teachers in Purba Medinipur District, West Bengal. Quantitative and qualitative findings consistently indicate that teachers who score higher on openness tend to implement more student-centered, interactive, and flexible teaching strategies. These teachers frequently incorporate real-life examples, encourage diverse student responses, and adapt lessons dynamically in response to students' questions and interests. Such behaviors foster critical thinking, creativity, and problem-solving skills among students, demonstrating the value of personality traits in enhancing classroom practices beyond traditional content delivery.

Although gender differences were observed, they were relatively minor compared to the influence of personality. Female teachers showed a slight preference for participatory and collaborative teaching styles, yet statistical analyses revealed that gender was not a significant predictor of inquiry-based teaching in this sample. This underscores that personality characteristics, particularly openness, play a more decisive role in determining instructional approaches than demographic factors like gender, suggesting that teacher development initiatives should prioritize fostering traits associated with openness rather than focusing primarily on gender-based differentiation.

The pilot study also confirmed the feasibility of the selected research instruments and methodology. The personality inventory measuring openness and the classroom observation rubric for inquiry-based teaching were both practical and reliable for use in local school contexts. Additionally, the study helped refine sampling procedures, observation schedules, and data collection techniques, providing a solid foundation for a larger-scale investigation. Preliminary effect sizes and observed variability further support the planning of more robust statistical analyses in future research, ensuring that subsequent studies can produce reliable and generalizable findings.

Overall, the findings emphasize the importance of professional development programs that cultivate creativity, flexibility, and responsiveness among teachers. Training initiatives should focus on enhancing teachers' openness-related behaviors, including adaptive lesson planning, the integration of real-world examples, and encouragement of active student participation. By promoting these qualities, educational stakeholders can support the adoption of inquiry-based teaching methods, ultimately improving student engagement, scientific reasoning, and conceptual understanding. The pilot study not only validates the research approach but also highlights a clear pathway for interventions aimed at enhancing the quality of science education in the region.

## 9. Limitations

- Small sample size limits generalizability.
- Only two observations per teacher.
- Self-report personality inventories may be influenced by social desirability.

## 10. Recommendations

- Conduct a large-scale study across multiple districts.
- Include longitudinal classroom observations.
- Integrate student learning outcomes.
- Explore interaction with other personality traits, such as conscientiousness and extraversion.

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