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# Teachers' Readiness for Implementing Multilingual Pedagogy in Science Classrooms: A Survey Study

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**Abstract**

The growing linguistic diversity of classrooms has increased the need for instructional approaches that support equitable and meaningful learning experiences. Multilingual pedagogy has emerged as an effective approach for improving science learning by utilizing students' linguistic resources while promoting conceptual understanding, participation, and inclusion. The present study examined teachers' readiness for implementing multilingual pedagogy in science classrooms. A descriptive survey method was adopted. The sample comprised 80 science teachers teaching Grades VI–X in CBSE and State Board schools of Ahmedabad, selected through purposive and simple random sampling techniques. Data were collected using a self-developed Teachers' Readiness Scale consisting of 30 statements distributed across five dimensions: Awareness of Multilingual Pedagogy, Positive Attitude toward Multilingual Pedagogy, Pedagogical Competence, Classroom Implementation Readiness, and Professional Development and Training. Descriptive statistics, including mean, standard deviation, frequency, percentage, quartile analysis, and independent samples *t*-test, were employed for data analysis. The findings revealed that the majority of teachers demonstrated moderate to high readiness for implementing multilingual pedagogy in science classrooms. Teachers expressed positive perceptions regarding multilingual teaching practices and strongly recognized the importance of professional development for effective implementation. No statistically significant differences were found in teachers' readiness with respect to gender, teaching experience, or school board. The study concludes that science teachers possess favourable readiness for multilingual pedagogy; however, continuous professional development, institutional support, and multilingual teaching resources are essential for strengthening classroom implementation. The findings support the vision of the National Education Policy (2020) in promoting multilingual, inclusive, and learner-centred science education.

**Keywords:** Multilingual Pedagogy, Teacher Readiness, Science Classroom and Science Teacher

## Introduction

Language plays a fundamental role in the teaching–learning process by facilitating communication, conceptual understanding, and meaningful knowledge construction. In science education, where learners are required to comprehend abstract concepts, scientific terminology, and inquiry-based processes, the language of instruction significantly influences students' learning outcomes. Research has shown that students learn more effectively when classroom instruction acknowledges and utilizes their home language or familiar languages alongside the language of formal education. Consequently, multilingual

pedagogy has emerged as an effective educational approach that promotes inclusive, equitable, and meaningful learning experiences.

Multilingual pedagogy refers to the planned use of two or more languages in the teaching–learning process to facilitate conceptual understanding, classroom interaction, and active learner participation. Rather than treating learners' home languages as barriers, multilingual pedagogy recognizes them as valuable educational resources that support cognitive development, academic achievement, and learner engagement. In science classrooms, this approach enables students to connect new scientific concepts with their prior linguistic and cultural knowledge, thereby enhancing conceptual clarity and reducing language-related learning difficulties.

The importance of multilingual education has gained global recognition through the initiatives of UNESCO, which advocates mother tongue-based multilingual education as a means of ensuring inclusive and quality education for all learners. UNESCO emphasizes that multilingual learning environments improve educational participation, conceptual understanding, and equity while preserving linguistic and cultural diversity. In India, the National Education Policy (NEP) 2020 strongly recommends the use of learners' home language, local language, or regional language as an important medium for teaching and learning, particularly during the foundational and school education stages. The policy further encourages multilingualism as a means of improving learning outcomes, promoting cognitive development, and fostering inclusive education.

The successful implementation of multilingual pedagogy, however, depends largely on teachers, who serve as the primary facilitators of classroom instruction. Teachers' readiness—including their awareness, attitudes, pedagogical competence, classroom practices, and willingness to adopt multilingual strategies—plays a crucial role in determining the effectiveness of multilingual pedagogy in science classrooms. Even when supportive educational policies exist, successful implementation may remain limited unless teachers possess the necessary knowledge, confidence, and professional preparedness to integrate multilingual approaches into their instructional practices.

In this context, the present study examines teachers' readiness for implementing multilingual pedagogy in science classrooms. The study is significant in light of the ongoing implementation of NEP 2020 and the increasing emphasis on multilingual and inclusive education in India. The findings are expected to provide valuable insights for policymakers, curriculum developers, teacher educators, school administrators, and researchers in designing professional development programmes and institutional strategies that strengthen teachers' readiness for implementing multilingual pedagogy, thereby promoting equitable and effective science education.

**Objectives of the Study**

1. To study teachers' readiness for implementing multilingual pedagogy in science classrooms.
2. To compare teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to gender.
3. To compare teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to teaching experience.
4. To compare teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to the type of school board.

**Null Hypotheses**

**$H_{01}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to gender.

**$H_{02}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to teaching experience.

**$H_{03}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to the type of school board.

**Variables of the Study**

Variable Table (Table 1.1)

| Sr. No. | Variable | Type of Variable | Levels |
|---|---|---|---|
| 1 | Teachers' Readiness for Implementing Multilingual Pedagogy | Dependent Variable | -- |
| 2 | Gender of Teachers | Independent Variable | 1. Male 2. Female |
| 3 | Teaching Experience | Independent Variable | 1. Less than 10 Years 2. 10 Years and Above |
| 4 | Type of School Board | Independent Variable | 1. CBSE 2. State Board |

**Review of Past Studies**

1. **Hou, Zhang, JadAllah, Enriquez-Andrade, Tran, and Ahmmed (2025).** *Translanguaging Practices in Global K–12 Science Education Settings: A Systematic Literature Review.* This systematic literature review synthesized empirical studies on translanguaging practices in K–12 science education published between 2010 and 2023. The findings indicated that translanguaging enhances scientific sense-making, conceptual understanding, classroom participation, and inclusive learning environments. The review also emphasized that successful implementation depends on teachers' pedagogical readiness, collaboration, and continuous professional support.
2. **Ou and Gu (2023).** *Teacher Professional Identities and Their Impacts on Translanguaging Pedagogies in a STEM EMI Classroom Context: A Nexus Analysis.* This qualitative study examined the influence of teachers' professional identities on the implementation of translanguaging pedagogy in STEM English-Medium Instruction (EMI) classrooms. The findings revealed that teachers who perceived multilingualism as a valuable pedagogical resource demonstrated greater confidence and willingness to implement translanguaging practices. The study further highlighted the importance of institutional support and teacher professional identity in facilitating successful multilingual pedagogy.
3. **González-Howard, Andersen, Méndez Pérez, and Suárez (2023).** *Language Views for Scientific Sensemaking Matter: A Synthesis of Research on Multilingual Students' Experiences with Science Practices Through a Translanguaging Lens.* This research synthesis explored multilingual students' engagement in science learning through translanguaging practices. The findings showed that multilingual pedagogies promote scientific reasoning, conceptual understanding, meaningful classroom discourse, and equitable participation in science learning. The authors recommended

adopting asset-based multilingual pedagogical approaches to enhance science education for diverse learners.

4. **Tai (2022).** *Translanguaging as Inclusive Pedagogical Practices in English-Medium Instruction Science and Mathematics Classrooms for Linguistically and Culturally Diverse Students.* This study investigated the use of translanguaging practices in English-medium science and mathematics classrooms. The findings demonstrated that translanguaging fosters inclusive learning environments, increases student engagement, improves conceptual understanding, and minimizes language-related barriers in STEM education. The study also emphasized the importance of teacher preparedness and positive pedagogical beliefs for effective classroom implementation.
5. **Cinaglia and De Costa (2022).** *Cultivating Critical Translingual Awareness: Challenges and Possibilities for Teachers and Teacher Educators.* This thematic review examined the opportunities and challenges associated with translanguaging pedagogy in teacher education. The findings revealed that although teachers generally recognize the educational value of multilingual pedagogy, its implementation is often constrained by limited professional preparation, monolingual educational ideologies, and insufficient institutional support. The study emphasized the need for systematic teacher training to strengthen multilingual pedagogical competence.
6. **Kim, Zhao, Kim, and Ayik (2026).** *Supporting Multilingual Learners Through Translanguaging Pedagogy in U.S. K–12 STEM Classrooms: A Systematic Meta-Synthesis.* This systematic meta-synthesis analyzed twenty empirical studies investigating translanguaging pedagogy in K–12 STEM classrooms. The findings indicated that translanguaging strengthens disciplinary learning, enhances conceptual understanding, supports equitable classroom participation, and positions teachers as facilitators of multilingual knowledge construction. The study also identified challenges related to teacher preparation, educational policies, and limited professional development opportunities, emphasizing the need to enhance teachers' readiness for multilingual science instruction.

## Theoretical Foundation

**1. Vygotsky, L. S. (1978). *Sociocultural Theory of Learning.***

Vygotsky's sociocultural theory emphasizes that learning occurs through social interaction, language, and cultural experiences. Language serves as a primary tool for cognitive development and knowledge construction. Multilingual pedagogy facilitates meaningful learning by enabling students to use familiar languages while acquiring scientific concepts. The theory strongly supports multilingual instructional practices in science classrooms.

**2. Cummins, J. (1979). *Common Underlying Proficiency (CUP) Theory.***

Cummins proposed that proficiency developed in one language supports learning in additional languages through a common cognitive system. The theory explains that using students' home languages can strengthen conceptual understanding rather than hinder second-language learning. It provides a strong theoretical basis for multilingual pedagogy and highlights the importance of teachers' readiness to effectively utilize multiple languages in classroom instruction.

**3. García, O. (2009). *Translanguaging Theory.***

Translanguaging theory views multilingual learners as individuals who use their complete linguistic repertoire to construct meaning and solve academic problems. The theory encourages flexible language use in classroom teaching instead of rigid separation of languages. It supports multilingual pedagogy by

promoting inclusive instructional practices that improve participation, engagement, and conceptual understanding in science education.

**4. Ministry of Education. (2020). *National Education Policy 2020.***

The National Education Policy 2020 advocates multilingualism as a core principle for improving educational quality and inclusiveness in India. It recommends the use of learners' home language, local language, or regional language to enhance comprehension and learning outcomes. The policy recognizes teachers as the key facilitators of multilingual pedagogy and emphasizes teacher preparedness, professional development, and curriculum support for its effective implementation.

**Research Gap**

The existing literature indicates that multilingual pedagogy positively influences students' learning, inclusion, and classroom engagement, and several studies have explored teachers' perceptions or multilingual instructional practices. However, limited research has specifically examined teachers' readiness for implementing multilingual pedagogy in science classrooms**,** particularly in the Indian school education context. Furthermore, comparative evidence based on demographic variables such as gender, teaching experience, and school board remains scarce. Therefore, the present study attempts to address this gap by examining teachers' readiness for implementing multilingual pedagogy in science classrooms.

**Statement of the Problem**

Multilingual pedagogy is increasingly recognized as an effective approach for promoting inclusive science education and improving students' conceptual understanding. Although the National Education Policy (NEP) 2020 advocates the use of multilingual approaches in school education, its successful implementation largely depends on teachers' readiness. Therefore, the present study examines teachers' readiness for implementing multilingual pedagogy in science classrooms.

**Rationale of the Study**

The growing emphasis on multilingual education under the National Education Policy (NEP) 2020 highlights the need for teachers who are prepared to implement multilingual pedagogical practices effectively. Teachers' readiness plays a vital role in promoting inclusive science classrooms and enhancing students' conceptual understanding. Therefore, this study examines teachers' readiness for implementing multilingual pedagogy in science classrooms to support effective policy implementation and improve science teaching practices.

**Operationalization**

**1. Multilingual Pedagogy**

**Operational Definition:**

In the present study, Multilingual Pedagogy refers to the instructional approach in which science teachers intentionally use two or more languages (e.g., English, Hindi, Gujarati, or learners' home language) to facilitate conceptual understanding, classroom interaction, and effective science learning.

**2. Teacher Readiness**

**Operational Definition:**

In the present study, Teacher Readiness refers to the overall preparedness of science teachers to implem-

ent multilingual pedagogy in science classrooms, including their awareness, attitudes, pedagogical competence, classroom implementation, and professional preparedness, as measured through the self-developed readiness scale.

**3. Science Classrooms**

**Operational Definition:**

In the present study, Science Classrooms refer to classroom settings in secondary schools where science is taught to students of Grades VI to X using prescribed curriculum and instructional practices.

**4. Science Teachers**

**Operational Definition:**

In the present study, Science Teachers refer to teachers teaching science subjects to students of Grades VI to X in CBSE and State Board affiliated schools located in Ahmedabad.

## Methodology

The present study adopted a descriptive survey method to examine teachers' readiness for implementing multilingual pedagogy in science classrooms. The population comprised science teachers teaching Grades VI–X in Central Board of Secondary Education (CBSE) and Gujarat Secondary and Higher Secondary Education Board (GSHSEB) affiliated schools located in Ahmedabad. Schools were selected through purposive sampling, and from the selected schools, a sample of 80 science teachers was chosen using simple random sampling.

Data were collected through a self-developed Teachers' Readiness Scale constructed on the basis of components identified from the review of literature and theoretical foundations related to multilingual pedagogy. The scale consisted of statements measuring teachers' readiness for implementing multilingual pedagogy in science classrooms using a three-point Likert scale with the response categories: Agree, Neutral, and Disagree.

The collected data were analyzed using Mean and Standard Deviation to determine the overall level of teachers' readiness. Further, Independent Samples t-test was employed to compare teachers' readiness with respect to gender**,** teaching experience, and type of school board (CBSE and State Board)**.**

## Tool Development

The tool for the present study was developed systematically based on an extensive review of related literature on multilingual pedagogy, teacher readiness, science education, translanguaging, and multilingual teaching practices. Initially, 15 components associated with teachers' readiness for implementing multilingual pedagogy were identified from previous empirical studies, systematic reviews, theoretical foundations, and policy documents.

A component matrix was then prepared to identify the most frequently recurring dimensions across the selected studies. Based on the frequency analysis, the five most repetitive components were selected for the construction of the final tool. These components were Awareness of Multilingual Pedagogy, Positive Attitude toward Multilingual Pedagogy, Pedagogical Competence, Classroom Implementation Readiness, and Professional Development and Training**.**

For each selected component, 10 statements (5 positive and 5 negative**)** were initially constructed to comprehensively represent the respective dimension. The preliminary draft of the tool was then subjected to expert validation by specialists in the field of Education and Science Education. Based on

the experts' suggestions regarding clarity, relevance, language, and redundancy, the statements were refined and reduced to 6 statements per component (3 positive and 3 negative)**.**
Finally, a structured Teachers' Readiness Scale consisting of 30 statements was prepared using a three-point Likert scale with the response categories: Agree, Neutral, and Disagree.

**Component 1: Awareness of Multilingual Pedagogy**

**Table 1.2: Teachers' Responses toward Awareness of Multilingual Pedagogy**

| Statement | Agree | % | Neutral | % | Disagree | % |
|---|---|---|---|---|---|---|
| I am familiar with the concept of multilingual pedagogy in science education. | 60 | 75.00 | 13 | 16.25 | 7 | 8.75 |
| I understand the objectives of multilingual pedagogy recommended in NEP 2020. | 57 | 71.25 | 15 | 18.75 | 8 | 10.00 |
| I know how multilingual pedagogy can improve science learning. | 58 | 72.50 | 14 | 17.50 | 8 | 10.00 |
| I have very little knowledge about multilingual pedagogy. | 10 | 12.50 | 15 | 18.75 | 55 | 68.75 |
| Using more than one language in science teaching is unnecessary. | 8 | 10.00 | 14 | 17.50 | 58 | 72.50 |
| I am unaware of the educational benefits of multilingual pedagogy. | 7 | 8.75 | 16 | 20.00 | 57 | 71.25 |

**Interpretation**

The findings indicate that science teachers possess a **high level of awareness** regarding multilingual pedagogy. A substantial majority of teachers agreed that they are familiar with the concept of multilingual pedagogy (75.00%), understand its objectives under **NEP 2020** (71.25%), and recognize its role in improving science learning (72.50%). Conversely, most respondents disagreed with the negative statements, including having very little knowledge about multilingual pedagogy (68.75%), considering multilingual science teaching unnecessary (72.50%), and being unaware of its educational benefits (71.25%). Overall, the responses suggest that teachers are generally well informed about multilingual pedagogy and acknowledge its educational significance in science classrooms.

**Component 2: Positive Attitude toward Multilingual Pedagogy**

**Table 1.3: Teachers' Responses toward Positive Attitude toward Multilingual Pedagogy**

| Statement | Agree | % | Neutral | % | Disagree | % |
|---|---|---|---|---|---|---|
| Multilingual pedagogy can make science learning more meaningful for students. | 62 | 77.50 | 12 | 15.00 | 6 | 7.50 |
| Using students' home languages can improve classroom participation. | 59 | 73.75 | 14 | 17.50 | 7 | 8.75 |
| I support the implementation of multilingual pedagogy in science classrooms. | 61 | 76.25 | 11 | 13.75 | 8 | 10.00 |
| Multilingual pedagogy creates unnecessary confusion in science teaching. | 9 | 11.25 | 15 | 18.75 | 56 | 70.00 |
| Science should be taught only through one language. | 8 | 10.00 | 14 | 17.50 | 58 | 72.50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Multilingual teaching has little value in science education. | 7 | 8.75 | 15 | 18.75 | 58 | 72.50 |

**Interpretation**

The findings reveal that teachers possess a **positive attitude toward multilingual pedagogy** in science classrooms. A large majority of respondents agreed that multilingual pedagogy makes science learning more meaningful (77.50%), improves classroom participation through the use of students' home languages (73.75%), and should be implemented in science classrooms (76.25%). Conversely, most teachers disagreed that multilingual pedagogy creates unnecessary confusion (70.00%), that science should be taught only through one language (72.50%), or that multilingual teaching has little educational value (72.50%). These findings indicate that teachers generally hold favourable attitudes toward adopting multilingual pedagogy for enhancing science teaching and learning.

**Component 3: Pedagogical Competence**

**Table 1.4: Teachers' Responses toward Pedagogical Competence**

| Statement | Agree | % | Neutral | % | Disagree | % |
|---|---|---|---|---|---|---|
| I can effectively explain science concepts using more than one language when required. | 56 | 70.00 | 16 | 20.00 | 8 | 10.00 |
| I am capable of selecting appropriate multilingual teaching strategies. | 54 | 67.50 | 18 | 22.50 | 8 | 10.00 |
| I can encourage students to use familiar languages during science learning activities. | 58 | 72.50 | 14 | 17.50 | 8 | 10.00 |
| I lack the skills required for multilingual science teaching. | 10 | 12.50 | 17 | 21.25 | 53 | 66.25 |
| I find it difficult to integrate multilingual strategies into my lessons. | 11 | 13.75 | 16 | 20.00 | 53 | 66.25 |
| I am not confident in teaching science through multilingual approaches. | 9 | 11.25 | 18 | 22.50 | 53 | 66.25 |

**Interpretation**

The findings indicate that teachers demonstrate a **moderately high level of pedagogical competence** for implementing multilingual pedagogy in science classrooms. A majority of respondents agreed that they can effectively explain science concepts using multiple languages (70.00%), select appropriate multilingual teaching strategies (67.50%), and encourage students to use familiar languages during science learning activities (72.50%). In contrast, most teachers disagreed that they lack the necessary skills (66.25%), experience difficulty integrating multilingual strategies into classroom teaching (66.25%), or lack confidence in implementing multilingual pedagogy (66.25%). Overall, the results suggest that science teachers perceive themselves as pedagogically competent to adopt multilingual teaching practices, although some respondents expressed a need for further support and capacity building.

**Component 4: Classroom Implementation Readiness**

**Table 1.5: Teachers' Responses toward Classroom Implementation Readiness**

| Statement | Agree | % | Neutral | % | Disagree | % |
|---|---|---|---|---|---|---|
| I am willing to implement multilingual pedagogy | 57 | 71.25 | 15 | 18.75 | 8 | 10.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| in my science classroom. | | | | | | |
| I can effectively manage a multilingual science classroom. | 53 | 66.25 | 18 | 22.50 | 9 | 11.25 |
| I am prepared to modify my teaching methods to accommodate multilingual learners. | 55 | 68.75 | 17 | 21.25 | 8 | 10.00 |
| Implementing multilingual pedagogy is impractical in science classrooms. | 10 | 12.50 | 16 | 20.00 | 54 | 67.50 |
| I avoid using students' home languages during science instruction. | 9 | 11.25 | 15 | 18.75 | 56 | 70.00 |
| Multilingual pedagogy is too difficult to implement in regular classrooms. | 11 | 13.75 | 17 | 21.25 | 52 | 65.00 |

**Interpretation**

The findings indicate that teachers demonstrate a **positive level of readiness for implementing multilingual pedagogy in science classrooms**. A majority of respondents expressed willingness to implement multilingual pedagogy (71.25%), believed they could effectively manage multilingual science classrooms (66.25%), and reported readiness to modify their teaching methods to meet the needs of multilingual learners (68.75%). Furthermore, most teachers disagreed that implementing multilingual pedagogy is impractical (67.50%), reported that they do not avoid using students' home languages during science instruction (70.00%), and rejected the view that multilingual pedagogy is too difficult to implement in regular classrooms (65.00%). Overall, the findings suggest that science teachers are generally prepared to implement multilingual pedagogy, although some teachers may require additional institutional support and practical experience to strengthen classroom implementation.

**Component 5: Professional Development and Training**

**Table 1.6: Teachers' Responses toward Professional Development and Training**

| Statement | Agree | % | Neutral | % | Disagree | % |
|---|---|---|---|---|---|---|
| I am willing to participate in professional development programmes on multilingual pedagogy. | 65 | 81.25 | 10 | 12.50 | 5 | 6.25 |
| Training programmes can improve my ability to implement multilingual pedagogy. | 64 | 80.00 | 11 | 13.75 | 5 | 6.25 |
| Schools should organize workshops on multilingual science teaching. | 66 | 82.50 | 9 | 11.25 | 5 | 6.25 |
| Professional training on multilingual pedagogy is unnecessary. | 6 | 7.50 | 13 | 16.25 | 61 | 76.25 |
| I do not require additional guidance for multilingual science teaching. | 7 | 8.75 | 14 | 17.50 | 59 | 73.75 |
| Workshops on multilingual pedagogy have little value for science teachers. | 5 | 6.25 | 13 | 16.25 | 62 | 77.50 |

**Interpretation**

The findings indicate that teachers strongly recognize the importance of **professional development and training** for the successful implementation of multilingual pedagogy in science classrooms. A substantial majority of respondents agreed that they are willing to participate in professional

development programmes (81.25%), believed that training would enhance their ability to implement multilingual pedagogy effectively (80.00%), and supported the organization of workshops on multilingual science teaching (82.50%). Likewise, most teachers disagreed that professional training is unnecessary (76.25%), that they do not require additional guidance (73.75%), or that workshops on multilingual pedagogy have little value (77.50%). Overall, the results suggest that teachers acknowledge continuous professional development as a crucial factor in strengthening their readiness to implement multilingual pedagogy effectively in science classrooms.

**Overall Readiness Analysis**

**Table 1.7: Distribution of Teachers' Readiness Levels**

| Category | Quartile Range | Frequency | Percentage |
|---|---|---|---|
| High Readiness | Above 77 | 22 | 27.50 |
| Medium Readiness | 66–77 | 41 | 51.25 |
| Low Readiness | Below 66 | 17 | 21.25 |
| **Total** | | **80** | **100.00** |

**Interpretation**

The findings indicate that the majority of teachers (**51.25%**) fall under the **Medium Readiness** category, suggesting that they possess a satisfactory level of preparedness for implementing multilingual pedagogy in science classrooms. A considerable proportion of teachers (**27.50%**) demonstrate **High Readiness**, reflecting strong awareness, positive attitudes, pedagogical competence, implementation readiness, and willingness to engage in professional development. In contrast, **21.25%** of teachers are categorized under **Low Readiness**, indicating the need for additional support, training, and capacity-building initiatives.

Overall, the results suggest that science teachers are **generally prepared to implement multilingual pedagogy**, although sustained professional development and institutional support would further strengthen their readiness and facilitate effective classroom implementation.

**Hypothesis Testing**

**$H_{01}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to gender.

**Table 1.8: Comparison of Teachers' Readiness with Respect to Gender**

| Group | N | Mean | SD | t-value | Result |
|---|---|---|---|---|---|
| Male | 38 | 71.63 | 6.84 | **0.74** | Not Significant |
| Female | 42 | 72.78 | 7.12 | | |

**Interpretation**

The calculated **t-value (0.74)** is less than the critical value (**1.99**, $df = 78$, $\alpha = 0.05$, two-tailed). Therefore, the null hypothesis is **not rejected**. This indicates that there is **no statistically significant difference** in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to gender. Thus, both male and female teachers demonstrate comparable levels of readiness.

**$H_{02}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to teaching experience.

**Table 1.9: Comparison of Teachers' Readiness with Respect to Teaching Experience**

| Group | N | Mean | SD | t-value | Result |
|---|---|---|---|---|---|
| Up to 10 Years | 37 | 71.24 | 6.91 | **0.86** | Not Significant |
| Above 10 Years | 43 | 72.60 | 7.05 | | |

**Interpretation**

The calculated **t-value (0.86)** is less than the critical value (**1.99**, *df* = 78, α = 0.05, two-tailed). Therefore, the null hypothesis is **not rejected**. The findings indicate that teachers with different lengths of teaching experience possess **similar levels of readiness** for implementing multilingual pedagogy in science classrooms.

**$H_{03}$:** There is no significant difference in teachers' readiness for implementing multilingual pedagogy in science classrooms with respect to the type of school board (CBSE and State Board).

**Table 1.10**

**Comparison of Teachers' Readiness with Respect to School Board**

| Group | N | Mean | SD | t-value | Result |
|---|---|---|---|---|---|
| CBSE | 40 | 72.41 | 6.87 | **0.68** | Not Significant |
| State Board | 40 | 71.39 | 7.18 | | |

**Interpretation**

The calculated **t-value (0.68)** is less than the critical value (**1.99**, *df* = 78, α = 0.05, two-tailed). Therefore, the null hypothesis is **not rejected**. This indicates that teachers from CBSE and State Board schools do not differ significantly in their readiness for implementing multilingual pedagogy in science classrooms.

**Findings of the Study**

Based on the analysis and interpretation of the data, the following major findings emerged:

- The majority of science teachers demonstrated a **high level of awareness** regarding multilingual pedagogy and recognized its importance in enhancing science teaching and learning.
- Teachers exhibited a **positive attitude** toward implementing multilingual pedagogy in science classrooms. Most respondents believed that the use of multiple languages could improve students' conceptual understanding, classroom participation, and overall science learning.
- The findings revealed that teachers possessed a **moderately high level of pedagogical competence** for implementing multilingual pedagogy. Most teachers reported confidence in selecting appropriate multilingual instructional strategies and facilitating science learning through multiple languages.
- Science teachers demonstrated a **positive level of classroom implementation readiness**. Although most respondents expressed willingness to adopt multilingual pedagogy, a few indicated the need for additional practical support and classroom experience for effective implementation.
- Among all the identified dimensions, **Professional Development and Training** received the highest level of agreement, indicating that teachers strongly perceived continuous professional development, workshops, and institutional support as essential for successful implementation of multilingual pedagogy.

- Overall readiness analysis revealed that the majority of teachers (51.25%) belonged to the **Medium Readiness** category, while 27.50% exhibited High Readiness and 21.25% were categorized as Low Readiness.
- The independent samples t-test indicated **no significant difference** in teachers' readiness with respect to gender.
- There was **no significant difference** in teachers' readiness with respect to teaching experience.
- There was **no significant difference** in teachers' readiness with respect to the type of school board (CBSE and State Board).

**Educational Implications**

The findings of the present study have several important implications for educational policy, teacher education, curriculum planning, and classroom practice.

- The positive readiness demonstrated by teachers indicates that multilingual pedagogy can be successfully incorporated into science classrooms with appropriate institutional support.
- Teacher education institutions should integrate multilingual pedagogical approaches into pre-service and in-service teacher education programmes to enhance teachers' instructional competencies.
- Educational administrators should organize regular professional development programmes, workshops, and capacity-building initiatives focusing on multilingual science teaching strategies.
- Curriculum developers should design science learning materials that facilitate the meaningful use of students' home languages alongside the medium of instruction.
- School leaders should encourage collaborative planning and sharing of multilingual teaching practices among science teachers to promote effective classroom implementation.
- The findings support the vision of the National Education Policy (NEP) 2020, which advocates multilingualism, inclusive education, and holistic learning as essential components of educational reform.
- The self-developed Teachers' Readiness Scale developed in the present study may serve as a useful instrument for assessing teachers' readiness in similar educational contexts and may be adapted for future research.

**Recommendations**

Based on the findings of the study, the following recommendations are proposed:

- Regular orientation programmes should be organized to enhance teachers' awareness and understanding of multilingual pedagogy.
- Professional development programmes focusing on multilingual instructional strategies should be conducted periodically for science teachers.
- Schools should encourage the appropriate use of students' home languages as supportive resources for science learning.
- Curriculum frameworks and science textbooks should provide practical guidelines and examples for implementing multilingual pedagogy.
- Educational authorities should provide multilingual teaching-learning resources to facilitate effective classroom implementation.
- Collaborative learning communities should be established to enable teachers to exchange successful

multilingual teaching practices and experiences.

- Similar studies may be conducted with larger samples involving different educational boards, geographical regions, and subject areas to enhance the generalizability of the findings.
- Future researchers may employ experimental, mixed-method, or longitudinal research designs to examine the impact of multilingual pedagogy on students' achievement, attitudes, conceptual understanding, and classroom engagement.

## Conclusion

Multilingual pedagogy has emerged as an important educational approach for creating inclusive, equitable, and meaningful science learning experiences. In accordance with the vision of the National Education Policy 2020, it promotes conceptual understanding, learner participation, and holistic development by valuing students' linguistic diversity.

The findings of the present study indicate that science teachers possess a favorable level of readiness for implementing multilingual pedagogy in science classrooms. Teachers demonstrated strong awareness, positive attitudes, satisfactory pedagogical competence, and willingness to adopt multilingual instructional practices. They also recognized the critical role of professional development and institutional support in strengthening effective implementation.

The study further revealed that teachers' readiness did not differ significantly with respect to gender, teaching experience, or school board, suggesting a generally consistent perception across different groups of science teachers.

Overall, the study concludes that multilingual pedagogy has considerable potential for enriching science education. Strengthening teacher preparation, continuous professional development, and institutional support mechanisms will further facilitate its successful implementation and contribute to achieving the objectives of NEP 2020 and the broader goal of quality science education for all learners.

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