

# Upper Primary Science Teachers' Beliefs about Teaching and Learning of Science and their Practices in relation to their Gender

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## ABSTRACT

Teacher beliefs and practices play an important role in the teaching learning processes. This article explores the diverse pedagogical beliefs held by teachers, aiming to illuminate the intricate connections between these beliefs and their classroom practices. The present study was conducted (i) to identify elementary science teachers' beliefs about teaching and learning of science with respect to gender and (ii) to study the difference between beliefs and practices with respect to gender. The common aspects of teaching and learning such as teaching strategies, learning of science and student roles were taken into account to reveals teachers' beliefs. The study used a mixed method design. Ten upper primary science teachers were selected using purposive sampling techniques. Data were collected by questionnaire and classroom observation schedule. The findings showed that there was alignment between the beliefs of male and female teachers regarding the importance of understanding the scientific process, the benefits of problem-based learning, and the role of students in science education. Notable differences were observed in the beliefs of male and female teachers concerning teaching strategies. Additionally, a significant disparity existed between the beliefs and practices of male and female teachers in terms of providing opportunities to students and emphasizing the importance of students' roles and performance in response to instruction with female teachers have more practice than male teachers.

**Keywords:** Science Teachers' Beliefs, Teaching and Learning of Science, Gender

Science education is of paramount importance in the elementary school curriculum. It equips elementary teachers with the essential knowledge of science concepts, effective teaching strategies, the ability to engage young learners, and a strong desire to make a positive impact on their students' lives. The beliefs held by elementary teachers significantly influence their curriculum planning, decision-making before and during lessons, and the overall classroom experience (Crawford, 2007). Teacher beliefs play a crucial role in shaping their thoughts, motivation, intentions, and behaviour (Clark & Peterson, 1986; Czerniak & Lumpe, 1996). Elementary teachers who embrace constructivist beliefs are more likely

to create student-centered learning environments (Hewson & Hewson, 1988). The classroom practices revealed that teachers were less inclined to enact inquiry-based instruction. Their incomplete view of inquiry act as a barrier in the implementation of inquiry-based teaching in the science classroom. Crowded classrooms, limited time, and inexperience of teachers in engaging students in inquiry were challenges that teachers face regularly in the classroom (Bhoi and Behera, 2021).

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The alignment between teachers’ beliefs, practices, and attitudes is particularly vital in the elementary setting, where students are forming their foundational understanding of the world. Teachers’ beliefs about teaching and learning profoundly impact their intentions in the classroom, which, in turn, influence their professional work, including lesson planning, assessment, and evaluation. When elementary teachers perceive themselves as facilitators of science knowledge and view science as a dynamic exploration, their teaching reflects these beliefs in more student-centered strategies. In such an approach, knowledge is co-constructed with students, fostering active participation and inquiry-based learning.

**Need and Justifications**

It was seen that how teachers teach and how students learn impacts the quality of education. These teaching and learning beliefs are complex and affect how teachers and students interact. It’s essential to understand why and how a science teacher’s beliefs influence the classroom. These beliefs aren’t just different from one subject to another but also from person to person. Even teachers who teach the same subject may have different ideas about how to teach and learn science. This diversity makes it intriguing for researchers. As a result, studying teachers’ beliefs has become a significant focus in education research. While many studies have explored what do teacher’s beliefs about teaching and learning of science and relationship with classroom practice, not much attention has been given to teachers’ beliefs about teaching and learning science and how they relate to what happens in the classroom with respect to gender.

**Objectives of the Study**

1. To study the types of beliefs that science teachers have about teaching and learning of science with reference to gender
2. To study the difference in teachers’ beliefs and practices about teaching and learning of science with reference to gender

**Research Questions**

1. What are the types of belief in teachers about science teaching in relation to their gender?

2. Is there any difference in teachers’ beliefs and practices about teaching and learning of science in relation to gender?

**MATERIAL AND METHODS**

The research is based on mixed method research framework. The study aimed to identify science teachers’ beliefs about teaching and learning of science and their practices in the classroom at elementary stage in relation to gender. The participants of the study were 10 elementary school science teachers from five CBSE Schools in Siliguri of West Bengal in India. An open-ended questionnaire was developed to elicit teachers’ beliefs. The classrooms observation used to collect data on teaching practices.

**RESULTS**

The collected data was analyzed in line with the objectives of the study. The investigator used frequency and frequency percentage and establish the appropriate interpretation. To study difference in teachers’ beliefs about science teaching with respect to gender, data was analysed dimensionally.

**Dimension 1: Teaching Strategies**

**Table 1:** Beliefs about teaching strategies of science and gender

Conceptions	Gender	Always		Sometimes		Never	
		f	%	f	%	f	%
Provide explanation to the students	Male	8	80	2	20	0	0
	Female	8	80	2	20	0	0
Provide opportunity to the students	Male	4	40	6	60	0	0
	Female	7	70	3	30	0	0
Using low cost TLM during teaching in demonstration method	Male	4	40	6	60	0	0
	Female	5	50	5	50	0	0

Table 1 show that beliefs about teaching strategies of science according to gender. Both male and female teachers highly believe of providing explanation to students with similar percentage. While 20% of both male and female teachers believe it should be sometime. A higher proportion of female (70%) believe that students should always be given opportunity compared to males (30%). Higher proportion of male (70%) believe it sometimes

as compared to female (30%). Slightly higher percentage of female teachers (50%) always believe on using low cost TLM during teaching in demonstration method as compare to male teachers (40%). Whereas more male teachers (60%) believes it should be sometime as compare to female (50%).

## Dimension 2: learning of science

**Table 2:** Beliefs about learning of science and gender

Conceptions	Gender	YES		NO	
		f	%	f	%
Memorisation and recall of scientific definitions facts and principles are necessary in the learning of science	Male	8	80	2	20
	Female	5	50	5	50
Understanding the process of science is important than obtaining the right answer	Male	9	90	1	10
	Female	9	90	1	10
Learning start with a problem	Male	8	80	2	20
	Female	9	90	1	10

Table 2 beliefs about learning of science according to gender. A higher percentage (90%) of female teachers believe that memorization and recall of scientific definition facts and principles are necessary for learning science compared to male (80%). Both male (90%) and female (90%) teachers mostly agreed that understanding the process of science holds greater significance than obtaining the right answers. Both male (80%) and female (90%) teachers mostly agree that learning should start with a problem, with a little higher proportion of female strongly support this idea compared to males.

## Dimension 3: Student's Role

**Table 3:** Beliefs about student's role and Gender

Conceptions	Gender	YES		NO	
		f	%	f	%
Students perform prescribed exercises as per the instruction of the teacher have well understanding of concept	Male	8	80	2	20
	Female	9	90	1	10
Students' ideas are useful for learning	Male	10	100	0	0
	Female	10	100	0	0
Asking questions that needs scientific explanation.	Male	9	90	1	10
	Female	9	90	1	10

Table 3 presents the beliefs about students' role in the context of gender. Both male (80%) and female

(90%) teachers generally believe that students who follow the teacher's instruction have a better understanding of concept, with female teachers showing a slightly stronger agreement. All teachers both male and female believe that students ideas are useful for learning process. Both male and female teachers (90%) strongly believe that one of the important role of students in the science classroom is to ask questions that requires scientific explanation.

## The study also aimed to investigated the correlation between teacher's beliefs and their practice in science classes with reference to gender

Here the correlation between teachers' beliefs and practices are discussed indifferent dimensions with reference to gender.

## Dimension 1: Teaching Strategies

70% male teachers always provide explanation in the class which is 10% lower than their beliefs (80%). Whereas 60% of female teachers always provide explanation which is 20% lower than their beliefs (80%). It indicates that male teachers practice is slightly lower than beliefs while female teachers practice is also slightly lower than their beliefs. Data shows that 40% male teachers believe on providing opportunity to students to develop their own understanding which is 10% higher than their actual classroom practice (30%) and also 70% female teachers provide opportunity to students which is 40% higher than their classroom practice (30%). This indicates that male teachers practice is slightly lower than their beliefs and female teachers practice is lower than their beliefs. 40% male teachers always apply demonstration method in their teaching by using L.C.T which is 10% higher than their classroom practices. Whereas among half of the sampled female teacher's beliefs it which is 10% higher than their classroom practices. This indicates that both male and female teachers' practices about different teaching strategies are slightly lower than their practices.

## Dimension 2: Learning of Science

80% male teachers believe it which is similar with their practice (80%) while 90% female teachers believe it which is only 40% more than their

**Table 4:** Practice about different Teaching strategies/ Processing of inquiry and gender

Conceptions	Gender	Always		Sometime		Never	
		f	%	f	%	f	%
1. The teacher provides an explanation to students in the classroom	Male	7	70	2	20	1	10
	Female	6	60	4	40	0	0
2. The teacher Provides the opportunity to students to develop their own understanding of science concepts in the science classroom	Male	3	30	7	70	0	0
	Female	3	30	5	50	2	20
3. Teachers perform an activity by using Low cost TLM.	Male	3	30	5	50	2	20
	Female	4	40	5	20	1	10

**Table 5:** Practice about different approaches learning and gender

Conceptions	Gender	YES		NO	
		f	%	f	%
Teachers prefer memorization and recall are the better way to learn science	Male	8	80	2	20
	Female	5	50	5	50
In the classroom teacher give more importance to understanding the process of science than obtaining the right answer	Male	8	80	2	20
	Female	9	90	1	10
Students are taught science as a problem-solving exercise	Male	9	90	1	10
	Female	9	90	1	10

**Table 6:** Beliefs about Student’s role and gender

Conceptions	Gender	YES		NO	
		f	%	f	%
1. Students role is important for planning of any activity in school	Male	8	80	2	20
	Female	9	90	1	10
2. Students who follow the instruction of the teacher have well understanding of concept	Male	7	70	3	30
	Female	8	80	2	20
3. Students asking scientific explanation questions and the learner use technology to solve problems	Male	7	70	3	30
	Female	6	60	4	40

practice (50%). This indicates that male teachers seem to implement this approach slightly more in their practice compared to female teachers .90% male teachers believe it which is 10% higher than their actual classroom practice whereas 90% female teachers believe it which is also similar with their practice. This indicates that female teachers have a slightly higher percentage of implementation of this approach in their practice compared to male teachers. 80% male teacher’s beliefs learning start with a problem which is 105 higher than their actual classroom practice. Whereas 80% female teacher’s belief it which is 10% more than their beliefs. This indicates that female teachers implement these approaches slightly higher than male teachers.

**Dimension 3: Student’s role**

All male and female teachers have beliefs about student’s role is important for planning of any activity in school which is 20% more than male teachers’ actual practice in the classroom and 10% more than female teachers practice it. It indicates that female teachers practice this approach more than the male teachers. 80% male teachers believe students perform as teachers’ instruction which is 10% more than their practice in class whereas 90% female teachers believe it which is 10% more than their actual practice (80%). This indicates that female teachers show a higher percentage in both beliefs and practice as compared to male teachers. 90% male teachers believe it which is 20% more than their actual classroom practice (70%) whereas 90%

female teachers believed it which is 30% more than their actual practice (65%). There is a significant difference between beliefs and practice for both male and female teachers. Both male and female teachers show a much lower percentage of practice as compared to their beliefs.

## MAJOR FINDINGS

1. Female teachers tend to prioritize memorization and recall more than their male counterparts, while both genders share similar views on the importance of understanding the scientific process and the benefits of problem-based learning in science education.
2. There are some notable differences in the beliefs about teaching strategies between male and female teachers. Female teachers are more inclined to believe in always providing opportunities to students and always using low-cost TLM during teaching demonstrations. Male teachers, on the other hand, are more likely to believe in providing opportunities sometimes and using low-cost TLM sometimes. However, both genders largely agree on the importance of providing explanations to students as a consistent teaching strategy.
3. There is alignment between male and female teachers' beliefs about the students' role in science education. Both genders emphasize the importance of students' active participation by following instructions, contributing their ideas, and asking scientifically relevant questions to enhance the learning process. However, female teachers tend to place a slightly higher emphasis on students following instructions compared to their male counterparts.
4. Both male and female teachers tend to have beliefs about certain teaching strategies such as providing explanation. Providing opportunity for students and using low-cost teaching aids that are higher than their actual classroom practices.
5. There are differences between the beliefs and practices of male and female teachers in these specific teaching approaches. Female teachers

tend to have a closer alignment between their beliefs and practices in providing opportunity to students, Learning start with a problem. While male teachers may have a more consistent practice in providing explanations but a larger gap between beliefs and practices in other areas, such as starting learning with a problem.

6. Female teachers have a stronger beliefs and practices about the importance of students' role and performance in response to instruction compare to their male counterparts. However, both male and female teachers face a gap between their beliefs and actual classroom practices.

## DISCUSSION

The result of the study showed that female teachers appear to prioritize memorization and recall more than male teachers. This suggests a potential gender difference in teaching approaches, with females leaning towards more traditional methods of learning. However, both genders share similar views on the importance of understanding the scientific process and problem-based learning, indicating a common ground in the broader goals of science education.

Female teachers tend to believe in always providing opportunities to students and consistently using low-cost teaching aids during demonstrations. In contrast, male teachers are more likely to believe in providing opportunities and using teaching aids only sometimes. However, both genders agree on the importance of providing explanations to students. This discrepancy in beliefs might result in variations in teaching methods between male and female teachers. It was supported by the study that male and female teachers differed in relation to their instructional strategies with female teachers have better instructional strategies than male teachers. (Frederick Kwaky Sarfo, Francis Amankwah, Francis Kwame Sam & Daniel Konin. (2015), Shaukat and Iqbal 2012).

Both male and female teachers emphasize the importance of students' active participation in science education, including following instructions, contributing ideas, and asking relevant questions. Female teachers, however, place a slightly higher

emphasis on students following instructions. This study was supported by the studies that both male and female teachers didn't differ in terms of classroom management and Student engagement. (Frederick Kwaky *et al.* (2015), Nejati, Hassani and Saharapour 2014). Both male and female teachers tend to hold beliefs about certain teaching strategies that are higher than their actual classroom practices. This indicates a gap between what they believe is ideal and what they can realistically implement in the classroom.

Female teachers appear to have a closer alignment between their beliefs and practices in providing opportunities to students and starting learning with a problem. In contrast, male teachers may have a more consistent practice in providing explanations but a larger gap between their beliefs and practices in other areas, such as problem-based learning. This suggests that female teachers may be more consistent in implementing certain teaching approaches.

Female teachers have stronger beliefs and practices regarding the importance of students' roles and performance in response to instruction compared to their male counterparts. However, both genders face a gap between their beliefs and actual classroom practices. This might indicate that while they recognize the importance of student engagement and performance, external factors or constraints in the classroom could be limiting their ability to fully realize these beliefs. It was not supported by the study that gender of participants does not play a significant role on the relationship between teachers' beliefs on classroom management and their actual classroom practices and this relationship is not gender bound (Aliakbari & Heida).

## CONCLUSION

This study investigated the beliefs and practices of science teachers at the elementary level with regard to gender. The research was based on a mixed-method framework, combining open-ended questionnaires and classroom observation. Science teachers, both male and female, held strong beliefs about teaching and learning in the science classroom. While both male and female teachers believed in providing explanations to students, female teachers tended to believe in providing students with more

opportunities to develop their understanding of science concepts. Both male and female teachers recognized the importance of understanding the process of science over rote memorization, with a slightly higher percentage of female teachers supporting this idea. Most teachers, irrespective of gender, believed in starting the learning process with a problem. Teachers, both male and female, believed that students' roles were important for planning activities in school. Female teachers had a slightly stronger belief in this regard. Female teachers tended to believe more strongly that students who followed teachers' instructions had a better understanding of concepts. Both male and female teachers believed that students asking scientific explanation questions and using technology to solve problems were important aspects of their roles in the classroom. Female teachers generally showed a slightly higher percentage of implementing their beliefs into classroom practices compared to male teachers.

This study highlights the strong influence of teachers' beliefs on their teaching practices in the science classroom. While both male and female teachers had distinct beliefs and practices, there was a common trend of beliefs often exceeding actual classroom implementation. These findings suggest the importance of aligning teachers' beliefs with their teaching practices and provide valuable insights for teacher training and professional development in the field of science education. Further research and interventions may be needed to bridge the gap between beliefs and practices in science teaching at the elementary level.

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