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INFLUENCE OF GENDER, SOCIAL GROUP AND LOCALE ON SCIENCE ACHIEVEMENT AT THE UPPER PRIMARY LEVEL

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Abstract
Science achievement at the upper primary level is a key determinant of students' academic progression and their preparedness for future learning. However, disparities in achievement continue to persist due to social and demographic factors. The present study examines the impact of gender, social group, and locale on achievement in science among upper primary students. The study is based on Class VIII students from selected districts of Chhattisgarh, and the data were analyzed using descriptive and inferential statistics. Findings reveal variations in science achievement across gender, with differences also evident among students belonging to different social groups such as Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), and General category. Further, locale emerged as a significant factor, with urban students outperforming their rural counterparts in science. The results suggest that socio-cultural background, access to educational resources, and school environment collectively influence students' achievement in science. The study highlights the need for targeted interventions and equity-focused strategies in science education to bridge the learning gaps and ensure quality education for all learners.

Keywords: *Science Achievement; Gender; Social Group; Locale; Upper Primary Students; Educational Equity; Learning Outcomes*

1. Introduction

Science education at the upper primary level is a critical stage in the development of learners as it lays the foundation for higher-order thinking, logical reasoning, and problem-solving abilities (Aggarwal, 2010). At this stage, students are introduced to a wide range of scientific concepts that not only expand their knowledge but also influence their attitude towards science learning in later stages. Achievement in science, therefore, serves as an important indicator of both the quality of teaching-learning processes and the extent of students' conceptual understanding (Best & Kahn, 2006; Koul, 2013).

Despite several educational reforms in India, disparities in students' academic achievement continue to exist due to social, cultural, and geographical factors (UNESCO, 2017). The National Achievement Survey (NAS) and other large-scale assessments consistently highlight gaps in science learning outcomes across gender, social groups, and locales (NCERT, 2015; NAS, 2021). While gender differences in achievement have often been studied, findings remain inconclusive—some studies suggest boys outperform girls, while others find either parity or better performance by girls (Block, 2006; Buch, 1991). Similarly, differences among social groups such as Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), and General category are well-documented, largely reflecting socio-economic status, parental education, and access to educational resources (Singh & Nath, 2014). Rashmi et al. (2022) found that household educational spending favors boys significantly at the upper primary level, and this disparity is more pronounced in rural areas (with boys receiving considerably higher spending than girls in both settings).

Locale is another important factor influencing students' achievement. Rural and urban schools often differ in terms of infrastructure, teacher availability, access to teaching aids, and learning environments. Students in urban areas generally have more opportunities for exposure to science-related activities compared to their rural counterparts (UNESCO, 2017). In the context of Chhattisgarh, a state characterized by social and regional diversity, these factors become even more relevant. The state's educational landscape includes significant tribal and rural populations, where challenges such as teacher shortages, limited facilities, and socio-economic constraints often hinder effective science learning (NCERT, 2015).

The present study, therefore, aims to examine the impact of gender, social group, and locale on achievement in science among upper primary students. By analysing the performance of upper primary students from two districts of Chhattisgarh, this study attempts to provide insights into how demographic and social factors shape learning outcomes in science. Such an understanding is essential for designing interventions that promote equity and improve the quality of science education at the elementary level.

2. Objectives of the Study

The present research was conducted with the following objectives:

1. To study the achievement in Science of upper primary students in relation to gender and social group.
2. To examine the effect of social group and gender on the Science achievement of students.
3. To compare the Science achievement of upper primary students in relation to locale (urban and rural).

3. Methodology

3.1 Research Design

The present study employed a descriptive survey research design to investigate the achievement in science among upper primary students in relation to gender, social group, and locale.

3.2 Population and Sample

The study was conducted on upper primary students (Class VIII) from government schools of selected districts of Chhattisgarh. A stratified random sampling technique was employed to ensure representation across gender (boys and girls), social groups (SC, ST, OBC, and General), and locale (urban and rural).

A total of 154 students, along with 14 science teachers and school principals, constituted the final sample. From each district, two rural schools and two urban schools were selected. The distribution of the sample is summarized in Table 1.

Table-1: Distribution of Sample for selected Districts of Chhattisgarh State

S. No.	Name of School	Type of School	Class	Number of Students	Number of Science Teachers
1.	Govt. Aadarsh Girls H. S. School Durg	Urban	VIII	40	05
2.	Govt. M.G.H.S. School Khandsara ,Dist. Bemetara	Rural	VIII	40	02
3.	Govt. H.S. School Lohandiguda,Dist. Bastar	Rural	VIII	37	03
4.	Govt. MLB G.H.S. School Jagdalpur, Dist. Bastar	Urban	VIII	37	04
	TOTAL			154	14

3.3 Research Tool

Achievement in science was measured using standardized achievement test scores obtained from the National Achievement Survey (NAS, Class VIII, 2021). These scores were used as dependent variables representing students' academic achievement in science. Student demographic details such as gender, social group, and locale were obtained from school records and NAS datasets.

3.4 Statistical Techniques

Descriptive statistics (Mean, Standard Deviation), *t-test*, and Two-way ANOVA were used to analyse the data.

4. Analysis and Results

4.1 General Profile of Students

For the present study, 154 students of Class VIII were selected from government schools of two districts of Chhattisgarh. The sample was drawn from two urban schools and two rural schools, using stratified random sampling. Table-2 presents the classification of students based on social group and gender.

It is evident from the table that the maximum number of students belong to the OBC (68) and ST (55) categories, followed by General (20) and SC (11) groups. The gender-wise distribution indicates that the number of female students (118) is considerably higher than that of male students (36).

Table-2: General Profile of class VIII students on the basis of Social Group and Gender for selected Districts of Chhattisgarh State

Profile		N
Social Group	SC	11
	ST	55
	OBC	68
	GEN	20
Gender	Male	36
	Female	118

4.2 Mean Scores of Male and Female Students in Science Achievement Test by Social Group

To assess the achievement of Class VIII students in science, the National Achievement Survey (NAS) test was administered. The test comprised 15 objective questions covering a range of scientific concepts. Students' performance was evaluated on the basis of their scores, and mean values were computed for different social groups (SC, ST, OBC, and General) across gender. The results are presented in Table-3.

Table - 3: Mean scores of male and female students in achievement in science for class VIII as per social group

Social group	Gender	Mean	Std. Deviation	N
SC	Male	6.00	.000	2
	Female	5.22	2.333	9
	Total	5.36	2.111	11
ST	Male	3.91	1.758	11
	Female	4.09	2.089	44
	Total	4.05	2.013	55
OBC	Male	5.80	1.740	15
	Female	5.25	2.075	53
	Total	5.37	2.007	68
GEN	Male	4.63	2.387	8
	Female	6.00	.953	12
	Total	5.45	1.761	20
Overall	Male	4.97	1.993	36
	Female	4.89	2.099	118
	Total	4.91	2.069	154

From the data presented above, it is evident that the overall performance of Class VIII students in science is not satisfactory, with the total mean score being only 4.91 out of 15. This reflects the presence of significant learning difficulties in understanding scientific concepts at the upper primary level.

- **Gender-wise performance**: The mean score of male students (M = 4.97) is marginally higher than that of female students (M = 4.89). However, the difference is negligible, suggesting that gender does not play a substantial role in science achievement in the given sample.
- **Social group performance**:
  - Students from the OBC (M = 5.37) and General (M = 5.45) categories scored relatively higher compared to those from the SC (M = 5.36) and especially the ST group (M = 4.05).
  - The lowest achievement was observed among ST students, while the highest achievement was recorded among General category students (particularly females with M = 6.00).
  - The minimum and maximum mean scores ranged between 3.91 (ST male) and 6.00 (SC male & General female), showing considerable variation across groups.

The overall low mean scores indicate that students lack conceptual clarity and understanding of scientific principles. Possible factors contributing to this underachievement may include:

- Lack of adequate infrastructural facilities in schools.
- Shortage or incompetency of science teachers.
- Teachers being overburdened with non-academic tasks.
- Students' low interest and motivation in learning science.
- Socio-economic challenges, especially in rural and tribal regions, where students may be engaged in household responsibilities alongside schooling.

Thus, while minor variations exist across gender and social groups, the overall findings highlight the urgent need to strengthen science pedagogy, classroom practices, and support systems at the upper primary level to improve student achievement.

4.3 Effect of Gender and Social Group on the Mean Achievement Scores of Class VIII Students in Science

Gender is often considered an important factor in shaping students' academic behaviour, attitudes, and achievement. Several studies (Block, 2006) have documented that male and female students differ in terms of academic performance in basic subjects such as Science, both at the upper primary and secondary levels. However, the extent of these differences is often mediated by socio-cultural and contextual variables such as social group and school environment.

The present study was designed to investigate the combined and separate effects of gender and social group on students' achievement in Science. For this purpose, a two-way ANOVA (2 × 3 factorial design) was applied to the data, and the results are presented in Table-4.

Table 4: Analysis of variance of students' mean achievement in Science

Source of variation	Sum of Squares	Df	Mean Square	F	Sig.
Social group	52.288	3	17.429	4.401	.005
Gender	.049	1	.049	.012	.911
Social group x Gender	13.946	3	4.649	1.174	.322
Error	578.187	146	3.960		
Total	4366.000	154			

The analysis reveals that the F-value for gender (F = 0.012, Sig. = 0.911) is smaller than the critical value at the 0.05 level of significance. This indicates that there is no statistically significant difference in Science achievement between male and female students. Thus, gender alone does not appear to influence the level of academic achievement in Science among Class VIII students.

On the other hand, the F-value for social group (F = 4.401, Sig. = 0.005) is significant at the 0.05 level. This finding clearly suggests that students' achievement in Science varies significantly across different social groups (SC, ST, OBC, and General). Hence, social group emerges as an important factor influencing Science achievement at the upper primary level.

Further, the interaction effect of social group and gender (F = 1.174, Sig. = 0.322) is not statistically significant, indicating that the combined effect of social group and gender does not have a substantial influence on Science achievement.

The results thus highlight that while gender has no significant effect, social group plays a crucial role in determining Science achievement. The distribution of mean scores among male and female students belonging to different social groups is presented in Figure-1.

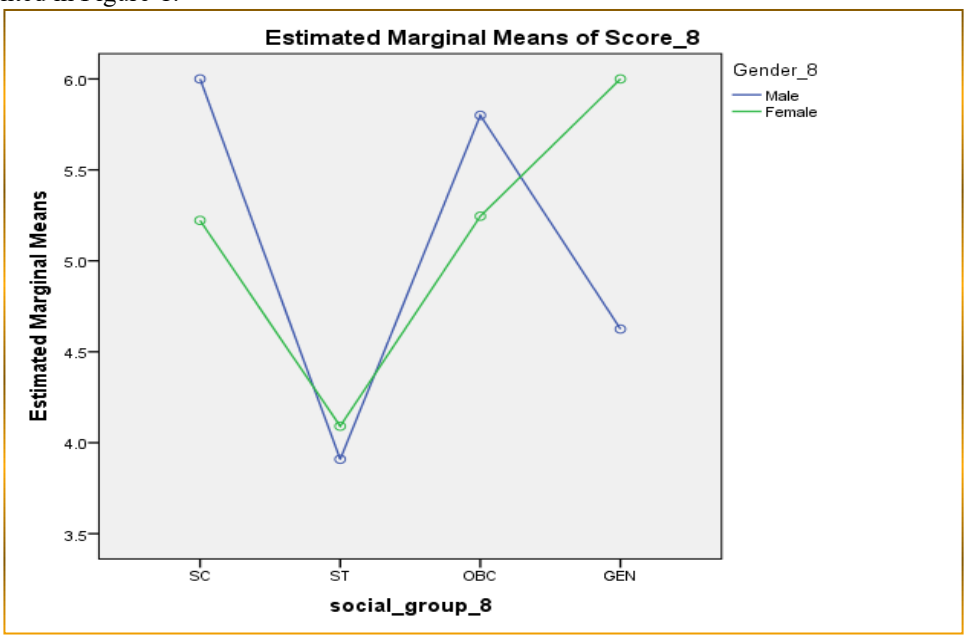

Fig.-1: distribution of mean scores among male and female students belonging to different social groups

From figure, it is evident that male students out-perform female students in the SC category, while in the General category, female students perform better than males. For OBC and ST categories, the performance of male and female students is almost similar.

4.4 Effect of Locale on the Academic Achievement in Science of Class VIII Students

Locale is an important demographic variable considered under the category of social variables in the present study. Human settlements are broadly classified into rural and urban areas based on population density, availability of infrastructure, and lifestyle patterns. These differences in socio-cultural and educational environments often influence the learning experiences and academic performance of students.

In the present investigation, the sample was drawn equally from two locales—rural and urban—of the selected districts of Chhattisgarh state. A total of 154 students were included in the study, with 77 students each from rural and urban schools. Their mean scores of achievements in Science were compared using the *t*-test, as presented in Table-5.

Table-5: Mean scores of achievements in science in relation to locale

Location		N	Mean	Std. Deviation	t-value	Df
Urban		77	5.21	1.982	1.805	152
Rural		77	4.61	2.122		

The data in Table-5 shows that the mean score of Science achievement for urban students (M = 5.21, SD = 1.982) is higher than that of rural students (M = 4.61, SD = 2.122). The obtained *t*-value (1.805) exceeds the critical value at the 0.05 level of significance, indicating a statistically significant difference in Science achievement between rural and urban Class VIII students.

These findings suggest that students from urban schools perform better in Science as compared to their rural counterparts. This difference may be attributed to factors such as better availability of educational resources, qualified teachers, enriched learning environments, and greater exposure to Science-related experiences in urban areas. Conversely, rural students may face challenges such as limited infrastructure, fewer learning aids, and less access to supplementary educational opportunities.

5. Discussion

The present study examined the academic achievement in science among upper primary students with respect to gender, social group, and locale. The findings provide important insights into the learning patterns and challenges of students at the upper primary level.

Firstly, the analysis of gender differences revealed that there was no statistically significant variation between male and female students in their science achievement scores. This result is consistent with several national and international studies which have reported that, at the middle school level, gender does not play a decisive role in determining science achievement (Block, 2006). However, some subtle variations were noticed, such as boys performing better in the SC category and girls performing slightly better in the General category. These variations, although not significant, suggest that gender roles and learning outcomes may be mediated by other contextual factors, such as family support, teacher expectations, and cultural perceptions regarding science learning.

Secondly, the results demonstrated that social group membership significantly influenced students' achievement in science. Students belonging to OBC and General categories performed better compared to those from SC and ST groups. This outcome highlights the persistent educational disparities linked to socio-cultural and economic backgrounds. Social groups with better access to resources, learning support, and educational opportunities tend to perform better academically. On the other hand, students from disadvantaged groups may face barriers such as lack of learning materials, limited exposure, and socio-economic hardships that hinder their science learning. These findings are aligned with earlier studies that have emphasized the role of social stratification in determining students' academic achievement in India.

Thirdly, the effect of locale was found to be significant, with urban students outperforming their rural counterparts. The higher achievement scores of urban students could be attributed to better infrastructural facilities, greater availability of qualified teachers, access to laboratories, and enriched learning environments in urban schools. In contrast, rural schools often face challenges such as teacher shortages, inadequate resources, multi-grade classrooms, and limited parental support for education. These factors contribute to lower achievement levels among rural students. The result is consistent with the findings of National Achievement Surveys and other research studies, which consistently report urban students performing better than rural students in science and other subjects.

Overall, the findings of the study suggest that while gender does not significantly impact science achievement, social group and locale are critical determinants of students' academic performance in science at the upper primary level. The lower mean scores across groups, irrespective of background, also indicate a general lack of conceptual understanding in science among students. This points towards broader systemic issues such as inadequate teaching practices, overburdened teachers, and low student motivation.

The implications of these findings are vital for policy makers and educators. There is a strong need to bridge the educational divide between different social groups and locales by ensuring equitable access to resources, effective teaching-learning processes, and targeted interventions for disadvantaged students. Strengthening teacher training, providing remedial support, and creating motivating and engaging science learning experiences can help address the learning difficulties observed in the study.

6. Findings

Based on the analysis of data related to the achievement in science of Class VIII students with respect to gender, social group, and locale, the following findings were drawn:

1. **Effect of Gender**
   - o The academic achievement in science of male and female students did not differ significantly.
   - o Both boys and girls showed almost similar levels of achievement, though slight variations were observed across specific social groups (boys performing better in SC, and girls performing better in General category).
2. **Effect of Social Group**
   - o A significant difference was found in the science achievement scores of students belonging to different social groups.
   - o Students from OBC and General categories performed better than students from SC and ST categories.
   - o This indicates that social group background plays a vital role in determining students' academic achievement in science.
3. **Effect of Locale**
   - o A significant difference was observed between the science achievement of urban and rural students.
   - o Urban students achieved higher mean scores compared to rural students, suggesting that location and availability of educational resources have a strong impact on science learning.
4. **Overall Achievement Trends**
   - o Although differences were noted on the basis of social group and locale, the overall mean scores of students indicate that a large proportion of learners are facing difficulties in achieving conceptual clarity in science at the upper primary level.
   - o The findings suggest that systemic issues such as limited resources, gaps in teaching-learning methods, and socio-economic disparities contribute to these learning challenges.

7. Educational Implications

The findings of the study carry significant implications for the teaching and learning of science at the upper primary level:

1. Gender-Neutral Pedagogical Approaches
   - o Since no significant difference was found between boys and girls in their science achievement, teachers should adopt gender-neutral teaching practices.

o Equal opportunities and encouragement must be provided to both boys and girls to enhance their scientific skills and conceptual understanding.

2. Addressing Social Group Disparities

o Achievement gaps across different social groups indicate the need for targeted interventions for socially disadvantaged students (SC and ST).

o Special remedial classes, mentoring programs, and inclusive teaching-learning materials should be developed to support these learners.

o Awareness programs for parents belonging to disadvantaged groups may also enhance students' motivation and participation in science learning.

3. Bridging the Rural–Urban Divide

o Higher achievement of urban students highlights the urgent need to improve science teaching facilities in rural schools.

o Adequate infrastructure such as laboratories, libraries, ICT tools, and access to activity-based science learning must be ensured in rural areas.

o Teachers posted in rural schools may be given additional training and professional support to handle challenges specific to their context.

4. Improving Teaching–Learning Practices

o The low mean achievement scores suggest that students lack conceptual clarity in science.

o Teachers should use activity-based, experimental, and inquiry-oriented methods rather than relying solely on rote learning.

o Regular diagnostic tests may help in identifying students' difficulties and providing timely remedial instruction.

5. Policy-Level Implications

o Educational policymakers must focus on equity in science education by ensuring that resources are equitably distributed across schools irrespective of social group or locale.

o Special schemes and scholarships may be introduced to motivate disadvantaged students to pursue science learning at higher levels.

o Integration of science with real-life situations, as emphasized in NEP 2020, should be prioritized to make science learning more engaging and meaningful.

8. Conclusion

The present study examined the impact of gender, social group, and locale on the achievement in science among upper primary (Class VIII) students of Chhattisgarh. The analysis revealed that gender did not play a significant role in influencing science achievement, suggesting that both boys and girls have similar potential and opportunities to perform in science when given equitable learning environments.

However, significant differences were observed among students belonging to different social groups. Students from socially advantaged categories (OBC and General) outperformed those from disadvantaged categories (SC and ST). This finding highlights the persistence of social inequalities in science learning outcomes, which may be attributed to socio-economic, cultural, and educational factors.

In terms of locale, the results demonstrated that urban students performed significantly better than rural students. The disparity reflects differences in infrastructure, availability of qualified teachers, exposure to modern teaching-learning aids, and parental support.

Overall, the study emphasizes that while gender equality has been relatively achieved in science learning, disparities due to social background and geographical location remain critical concerns. Addressing these gaps requires targeted interventions, improved facilities in rural schools, inclusive pedagogical strategies, and policy-level initiatives aimed at equity in education.

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