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Research Article

SCIENTIFIC ATTITUDE AND PROBLEM SOLVING ABILITY AMONG SENIOR SECONDARY SCHOOL STUDENTS OF NAMCHI, SIKKIM

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Abstract

This study investigates the scientific attitude and problem solving ability among senior secondary school students of Namchi, Sikkim, examining differences based on gender and locale and exploring the relationship between these variables. Utilizing a quantitative approach and a descriptive survey method, data was collected from 100 students using standardized tools. Two tools were used in this study Scientific Attitude Scale by S. Bajwa and M. Mahajan and Problem Solving Ability Test by L.N. Dubey. The findings indicate that a majority of students possess an average scientific attitude, while most exhibit very low problem-solving ability. The finding shows that there is no significant difference in scientific attitude and the problem solving ability among Science students with respect to gender and locale. Furthermore, the correlation analysis between scientific attitude and problem-solving ability shows a negligible relationship, suggesting that these constructs operate independently within this sample.

Keywords: Scientific Attitude, Problem Solving Ability, Senior Secondary School Students, Science Education.

INTRODUCTION

An attitude is a psychological construct inferred from observable responses to stimuli, mediating consistency among those responses (Pitafi & Farooq, 2012). It represents an individual's inner feeling or belief towards a phenomenon, shaped by past experiences, and includes both an image and emotional state. Attitudes have emotional content and vary in intensity and scope depending on the objects or situations they pertain to (Budhwar, 2017). In science education, attitude encompasses emotions, convictions, and principles related to science, such as scientific activities, school science, and the impact of science and technology (R, 2020). Scientific attitude involves analyzing reasons behind events, understanding their connections, and drawing conclusions based on experimental evidence. So, students need to adopt this scientific approach (Akcay *et al.,* 2010; Channawar, 2018). According to Shrivastava (1983), it's understood that having a scientific attitude is important. Even if you know a lot about science, it doesn't help national development or social change unless we also have this attitude. That's why teaching science in a way that encourages this scientific attitude has been highlighted in science education (Singh & Bai, 2017).Scientific attitude involves solving problems, evaluating ideas and information, and gathering evidence before making decisions. If evidence is insufficient, judgment is suspended until enough information is available. Teachers should foster a questioning mind and a spirit of inquiry to develop this attitude in students. Students should actively practice and observe science to cultivate a scientific attitude (Gokul & Malliga, 2015). A problemis a situation, person, or thing that needs attention and must be dealt with or solved. A problem is similar to a challenging work, circumstance, or person that is challenging to manage because it is complicated and unclear. Simply put, it's a question we must answer or a situation we must figure out. Regardless, it's a challenging thing that often leaves us unsure or confused (Dubey, 2008; Seel, 2012). Problem-solving, the highest level of learning, involves using principles and facts to explain new phenomena, predict outcomes, and analyze cause-effect relationships (Devi, 2016). Problem solving involves using two different ways of thinking: logical thinking and creative thinking. Logical thinking involves organizing, comparing, and selecting the best option to make sense of a problem. In closed situations, analytical thinking dominates as it helps identify and analyze all possible causes to find the true one (Singh & Veer, 2017). In a nutshell, problem solving is cognitive processing directed at transforming a problem from the given state to the goal state when the problem solver is not immediately aware of a solution method. It is related to other terms such as thinking, reasoning, decision-making, critical thinking, and creative thinking. The scientific attitude among senior secondary students was at a moderate level, with studies indicating that locale does affect the scientific attitude (Kumer & Kumer, 2017; Kundu, 2018; Paul & Kumari, 2020). However, studies also suggest that there are no significant differences in scientific attitudes based on gender (Revati & Meera, 2017; Paul & Kumari, 2020). The majority of students had a very low level of problem-solving ability (Kumer, 2021). The studies showed that there were no significant differences in problem solving ability based on gender (Singh & Veer, 2017; Dawngliani *et al.,* 2019; Kumer, 2021). The studies found that there was no significant relationship between scientific attitude and problem solving ability among higher secondary school students (Kalaivani & Pugalenthy, 2015). However, Ocak et al. (2021) found a negative and weak association between students' problem-solving skills and scientific attitudes. Specifically, this negative relationship was observed among female students, but it was not statistically significant for male students. Several gaps have been identified in the existing literature regarding scientific attitude and problem-solving ability among senior secondary school students in India. There are inconsistencies in gender differences, with some studies indicating higher scientific

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attitudes among boys (Lucas, 2016), while others show no significant gender-based disparities (Revati & Meera, 2017; Paul & Kumari, 2020). Additionally, the influence of socioeconomic factors, such as urban-rural locality, on these abilities (Kumer & Kumer, 2017) suggests a need for further research. Despite extensive research, gaps remain in understanding the relationship between scientific attitude and problem-solving ability, especially within the specific context of senior secondary school students in Namchi, Sikkim. No existing studies have focused on this demographic, highlighting the need for targeted investigation in this unique geographical context.

Objectives of the Study

- To study the level of scientific attitudes among senior secondary school students of Namchi, Sikkim.
- To study the level of problem solving ability among senior secondary school students of Namchi, Sikkim.
- To find the differences in the scientific attitude among senior secondary school students of Namchi, Sikkim based on gender and locale.
- To find the differences in the problem solving ability among senior secondary school students of Namchi, Sikkim based ongender and locale.
- To find out the relationships between scientific attitude and problem solving ability among senior secondary school students of Namchi, Sikkim.

Hypotheses of the Study

$H_0$1: There is no significant difference in scientific attitude between males and females of senior secondary school students.

$H_0$2: There is no significant difference in scientific attitude between rural and urban senior secondary school students.

$H_0$3: There is no significant difference in problem solving ability between males and females of senior secondary school students.

$H_0$4: There is no significant difference in problem solving ability between rural and urban senior secondary school students.

$H_0$5: There is no significant relationship between scientific attitude and problem solving ability among senior secondary school students.

Delimitations of the Study

The study is delimited to the class XII science students belonging to eight Government Senior Secondary Schools of urban and rural areas from Namchi, Sikkim, affiliated to the Central Board of Secondary Education (CBSE).

RESEARCH METHOD

The present study used a quantitative research approach to examine the scientific attitude and problem solving ability among senior secondary school students of Namchi, Sikkim, considering gender and locale. The researcher utilized a descriptive survey method to conduct the study. The population consisted of 221senior secondary school students from eight Government Senior Secondary Schools in Namchi, Sikkim, within the age group of 16-18 years. A sample of one hundred students was selected from this population. The sampling technique used was stratified random sampling, ensuring a balanced representation of sub-groups. Standardized tools were used to collect data on scientific attitude and problem-solving ability, specifically the Scientific Attitude Scale (BMSAS) developed by S. Bajwa and M. Mahajan (2009) and the Problem Solving Ability Test (PSAT) developed by L.N. Dubey (2008).

RESULTS

Level of scientific attitude among senior secondary school students of Namchi, Sikkim

The data presented in Table 1, indicate that 5% of participants exhibit a very high level of scientific attitude. Conversely, none were categorized as having a high scientific attitude. Approximately 20% were found to possess an above-average scientific attitude, while around 27% demonstrated an average level. Moreover, 17% displayed a lower average scientific attitude, 8% fell below average, and 13% exhibited a low scientific attitude. Only 6% were classified as having a very low scientific attitude. The data obtained from the study showed that most students have an average and above-average scientific attitude. This means that the majority of students exhibit average, above average levels of rationality, curiosity, open-mindedness, faith in the scientific method, and aversion to superstition respectively, according to the tool used for the study.

Level of problem solving ability among senior secondary school students of Namchi, Sikkim

The data presented in Table 2, revealed that none of the students were identified in the ranges of 16 and above (very high ability) or 14-15 (high ability) for problem-solving ability. Only 8% were identified as having an average problem-solving ability, ranging from 12-13. About 14% were found to have low problem-solving ability, within the range of 10-11. The majority, 78%, were identified as having very low problem-solving ability, with scores of 9 and below.The data obtained from the study showed that most students have a very low problem solving ability.

Differences in the scientific attitude among senior secondary school students of Namchi, Sikkim based on gender

From Table 3, the mean score and standard deviation on scientific attitude for male students were (M=164.42, S.D. =15.33), and for female students, it was (M=168.88, S.D. =12.98), indicating that female students have a slightly higher scientific attitude than male students. The 't' value was not significant at 0.05 level, with t (98) =1.57, less than the critical value of 1.98 at 0.05 significance level and 98 degrees of freedom. Therefore, the null hypothesis stating *"No significant difference in scientific attitude between rural and urban class XII science students*" is failed to be rejected.

Thus, it inferred that male and female student exhibit the same levels of rationality, curiosity, open-mindedness, faith in the scientific method, and aversion to superstition.

Table 1. Frequency and Percentage of Scientific Attitude among Senior Secondary School Students of Namchi, Sikkim

Stanine scale	Percentile	Raw score	Frequency	Percentage (%)	Interpretation
9	P_{99}	209	5	5 %	Very High
8	P_{96}	196	0	0%	High
7	P_{89}	190	4	4%	High Average
6	P_{77}	182	20	20%	Above Average
5	P_{60}	173	27	27%	Average
4	P_{40}	165	17	17%	Lower Average
3	P_{23}	159	8	8%	Below Average
2	P_{11}	155	13	13%	Low
1	P_{4}	140	6	6%	Very Low

Source: Field Survey, 2024

Table 2. Frequency and Percentage of Problem Solving Ability scores of Total Sample

Classification	Frequency	Percentage (%)	Interpretation
16 & above	0	0%	Very High Ability
14-15	0	0%	High Ability
12-13	8	8%	Average Ability
10-11	14	14%	Low ability
9 & below	78	78%	Very Low ability

Source: Field Survey, 2024

Table 3. Results of t-test examining the difference between Male and Female of senior secondary school students about the variable of Scientific Attitude

Variable	Male (50)		Female (50)		$t_{(98)}$	Sig. (2-tailed)	Remark
	M	SD	M	SD			
Scientific Attitude	164.42	15.33	168.88	12.98	1.57	0.05	Not significant

Source: Field Survey, 2024

Table 4. Results of t-test examining the difference between Rural and Urban senior secondary school students in relation to the variable of Scientific Attitude

Variable	Rural (50)		Urban (50)		$t_{(98)}$	Sig. (2-tailed)	Remark
	M	SD	M	SD			
Scientific Attitude	164.10	15.55	169.20	12.59	1.80	0.05	Not significant

Source: Field Survey, 2024

Table 5. Results of t-test examining the difference between Male and Female of senior secondary school students in relation to the variable of Problem Solving Ability

Variable	Male (50)		Female 50)		$t_{(98)}$	Sig. (2-tailed)	Remark
	M	SD	M	SD			
Problem solving ability	7.60	2.47	7.06	2.77	1.03	0.05	Not significant

Source: Field Survey, 2024

Table 6. Results of t-test examining the difference between Rural and Urban senior secondary school students in relation to the variable of Problem Solving Ability

Variable	Rural (50)		Urban (50)		$t_{(98)}$	Sig. (2-tailed)	Remark
	M	SD	M	SD			
Problem solving ability	7.20	2.33	7.46	2.92	0.49	0.05	Not significant

Source: Field Survey, 2024

Differences in the scientific attitude among senior secondary school students of Namchi, Sikkim based on locale

From Table 4, the mean score and standard deviation on scientific attitude for rural students were (M=164.10, S.D. =15.55), and for urban students, it was (M=169.20, S.D. =12.59), indicating that urban students have slightly higher scientific attitude than rural students. The 't' value was not significant at 0.05 level, with t (98) = 1.80, less than the tabular value of 1.98 at 0.05 significance level and 98 degrees of freedom. Therefore, null hypothesis that states, *"There is no significant difference in scientific attitude between rural and urban of class XII science students"* is failed to be rejected. It could be thus inferred that rural and urban students exhibit the same levels of rationality, curiosity, open-mindedness, faith in the scientific method, and aversion to superstition respectively, according to the tool used for the study.

Differences in the problem solving ability among senior secondary school students of Namchi, Sikkim based on gender

From Table 5, the mean score and SD on problem-solving ability for male students were (M=7.60, S.D. =2.47), and for female students, it was (M=7.06, S.D. =2.77), indicating similar problem-solving abilities among male and female students. The 't' value was not significant at 0.05 level, with t (98) = 1.027, less than the tabular value of 1.98 at 0.05 significance level and 98 degrees of freedom. Therefore, the null hypothesis that states, *"There is no significant difference in problem solving ability between male and female of class XII science students."* is failed to be rejected. It could be thus inferred that males and females do not differ in their level of problem solving ability.

Differences in the problem solving ability among senior secondary school students of Namchi, Sikkim based on locale

From Table 6, the mean score and SD on problem solving ability for rural students were (M=7.20, S.D. =2.33), and for urban students were (M=7.46, S.D. =2.92), indicating similar problem-solving ability among rural and urban students. The 't' value was not significant at 0.05 level, with $t_{(98)} = 0.49$, less than the critical value of 1.98 at 0.05 significance level and 98 degrees of freedom. Therefore, the null hypothesis that states, *"There is no significant difference in problem solving ability between rural and urban class XII science students"* is failed to be rejected. Thus, It could be inferred that rural and urban students do not differ in their problem-solving ability.

Relationships between scientific attitude and problem solving ability among senior secondary school students of Namchi, Sikkim

Table 7. Correlation between Scientific Attitude and Problem Solving Ability among senior secondary school students of Namchi, Sikkim

Correlation		
Variable	SA	PSA
Scientific Attitude	1	0.08
Problem Solving Ability	0.08	1

Source: Field Survey, 2024

From Table 7, shows the value of r is 0.08, which indicates the correlation is not significant at 0.01 level and 0.05 level. So, the null hypothesis is accepted at 0.01 and 0.05 level. Therefore, the null hypothesis that states, *"There is no significant relationship between scientific attitude and problem solving ability among class XII science students."* is failed to be rejected. It could be thus inferred that there is no correlation between scientific attitude and problem solving ability.

DISCUSSION

The result of the study indicates that the scientific attitude of most students in Namchi, Sikkim is at an average level. It has been found in the present study that there is no significant difference in scientific attitude between male and female students. Similarly, the present study revealed that there is no significant difference in scientific attitude between rural and urban students. In the context of problem-solving ability, the study found that the majority of students have very low problem-solving ability. The present study also found no significant difference in problem-solving ability between male and female students. Similarly, the study revealed that there is no significant difference in problem-solving ability between rural and urban students. Furthermore, the present study found no correlation between scientific attitude and problem-solving ability. This suggest that variations in Scientific attitude do not correspond to differences in problem solving ability.

Suggestions

The study makes humble suggestions for:

- The State government should also increase funds for science education to provide resources for modern labs, equipment, and training programs. The State government should invest in continuous, standardized professional development programs for teachers to enhance their scientific knowledge and pedagogical skills. Well-trained teachers are crucial for delivering effective science education and inspiring students to pursue careers in these fields.
- School heads should ensure the effective implementation of curriculum standards that foster scientific attitudes and problem-solving skills among students. Encourage and support teachers in attending workshops and professional training on innovative science teaching methods.
- Science Teachers should use active learning strategies, such as experiments, projects, and group discussions, to engage students in scientific thinking and problem-solving. Teaching should connect scientific concepts to real-world scenarios to show their practical applications.
- Students should be encouraged to develop a habit of questioning and seeking to understand the underlying reasons and mechanisms behind scientific phenomena. Students should be encouraged to work collaboratively with peers to exchange ideas, solve problems collectively, and gain diverse perspectives, fostering a deeper understanding of scientific principles.

Conclusion

The study of senior secondary school students in Namchi, Sikkim, reveals significant insights into their scientific attitudes and problem-solving ability. The majority of these students have average to above-average scientific attitudes, characterized by rationality, curiosity, open-mindedness, faith in the scientific method, and aversion to superstition. However, a concerning finding is the very low problem-solving ability among most students, with only a few showing average skills in intelligence and reasoning. Notably, there are no significant differences in scientific attitude or problem-solving ability based on gender or locale, indicating these attributes are similar across all groups. Additionally, the study found no significant correlation between scientific attitude and problem-solving ability, suggesting that these attributes do not influence each other within this student population. These findings highlight the need for educational interventions to enhance problem-solving skills while maintaining and improving scientific attitudes among students. Targeted programs should be developed to specifically address the students' intelligence and reasoning abilities through practical and applied learning methods, alongside activities that foster and sustain their scientific attitudes.

REFERENCES

Akcay, H., Yager, R. E., Iskander, S. M., & Turgut, H. (2010). Change in student beliefs about attitudes toward science in grades 6-9. *Asia-Pacific Forum on Science Learning and Teaching, 11*(1).
https://www.eduhk.hk/apfslt/download/v11_issue1_files/akcay.pdf

Bajwa, S., & Mahajan, M. (2009). *Manual for scientific attitude scale.* National Psychological Corporation.

Budhwar, K. (2017). The role of technology in education. *International Journal of Engineering Applied Sciences and Technology, 2*(3), 55-57. https://www.ijeast.com/papers/55-57,TESMA208,IJEAST.pdf

Channawar, S. N. (2018). A study of scientific aptitude among government high school students of Raipur. *International*

Journal of Creative Research Thoughts (IJCRT), 6(2), 230-233. https://www.ijcrt.org/papers/IJCRT1892531.pdf

Dawngliani, M. (2019). A study on problem solving ability of government secondary school students in Aizawl city with reference to gender. *International Journal of Peace, Education and Development*, 7(2). https://doi.org/10. 30954/2454- 9525.02.2019.5

Devi, K. P. (2016). Role of problem solving ability on enhancing students. *PARIPEX - Indian Journal of Research, 5*(2), 238-240. https://www.worldwidejournals. com/paripex/recent_issues_pdf/2016/February/role-of-problem-solving-ability-on-enhancing-students-achievement_.pdf

Dubey, L. N. (2008). *Manual for problem solving ability test*. National Psychological Corporation.

Gokul, R. R., & Malliga, T. (2015). A study on scientific attitude among pre-service teachers. *Research Journal of Recent Sciences*, 196-198. https://www.isca.in/rjrs/ archive/v4/iIYSC-2015/34.ISCA-IYSC-2015-16EduS-04.pdf

https://smartlib.umri.ac.id/assets/uploads/files/c176a-iji_2020 _1_26.pdf

Kumar, A. (2021). Problem solving ability of high school students in relation to their gender, area and type of school. *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), 7*(1), 87-95. doi: 10.48175/568

Kalaivani, C., & Pugalenthy, N. (2015). Problem-solving ability and scientific attitude of higher secondary school students. *Shanlax International Journal of Arts, Science and Humanities, 2*(3). https://www.shanlaxjournals. in/pdf/ASH/V2N3/Ash_V2_N3_005.pdf

Kundu, S. (2018). A critical study of scientific attitude among the students of secondary schools. *Harvest (0nline); Bi-Annual, 3*(2), 14-28. http://www.harvestjournal.net/wp-content/uploads/2019/01/Subhasish-Kundu.pdf

Kumar, M. (2020). A study of problem solving ability and creativity among the higher secondary students. *Shanlax International Journal of Education*, *8*(2), 30-34. https://doi.org/10.34293/education.v8i2.2091

Kumar, K., & Kumar, T. R. (2017). Scientific attitude among higher secondary students. *Global Journal for Research Analysis, 6*(7), 340-341. https://www.worldwidejournals. com/global-journal-for-research-analysis-GJRA/fileview/July_2017_1500123467__88.pdf

Lucas, P. (2016). A study of scientific attitude and academic achievement in science of secondary school students in Thane city. *Anveshana's International Journal of Research in Education, Literature, Psychology and Libary Sciences, 1*(1), 68-74. http://publications.anveshanaindia.com/?smd_process_download=1&download_id=2993

Revati N., & Meera, K. P. (2017). An Investigation of Scientific Attitude among Secondary School Students in Kottayam District of Kerala. *OSR Journal of Research & Method in Education (IOSRJRME) 07*(01), 63-66. http://dx.doi.org/10.9790/7388-070103636

Ocak, G., Dogruel, A. B., & Tepe, M. E. (2021). An analysis of the relationship between problem solving skills and scientific attitudes of secondary school students. *International Journal of Contemporarary Research, 8*(1), 72-83. doi:https://doi.org/10.33200/ijcer.780710

Paul, P. H., & Kumari, V. S. (2020). Scientific attitude of high school. *PARIPEX - Indian Journal of Research, 9*(2), 49-50. https://doi.org/10.36106/paripex/2609705.

Pitafi, A. I., & Farooq, M. (2012). Measurement of scientific attitude of secondary. *Academic Research International, 2*(2), 379-392. http://www.savap.org.pk/journals/ARInt./ Vol.2(2)/2012(2.2-43).pdf

R, R. (2020). Attitude of urban and rural adolescents towards science. *Bhartiyam International Journal of Education & Research, 10*(1), 1-18. http://www.gangainstituteof education.com/attitude-of-urban-and-rural-adolescents-towards-science.pdf

Seel, N. M. (2012). *Encyclopedia of the Sciences of Learning*. Boston: Springer. https://doi.org/10.1007/978-1-4419-1428-6_914

Singh, N., & Veer, Y. (2017). A comparison of problem solving ability of male and female senior sedcondary scheduled caste school belonging to Kullu and Mandi districts of Himachal Pradesh. *Scholarly Research Journal for Interdisciplinary Studies, 7*(33), 8922-8930.https://oaji.net/articles/2019/1201-1561792105.pdf

Singh, Y. C., & Bai, C. A. (2017). A study of scientific attitude of secondary school students in West Tripura district. *International Journal of Informative & Futuristic Research, 4*(5), 6231-6237. https://www.researchgate.net/ publication/338108360_A_Study_of_Scientific_Attitude_of_Secondary_School_Students_in_West_Tripura_District

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