

Exploring the Space-Related Aptitude of Higher Secondary School Students: A Unique Study Considering Gender, Area, and Standard of North Gujarat.

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Abstract:

This research examines the space-related aptitude of higher secondary school students in North Gujarat, India, considering gender, geographical area, and academic standard. A standardized aptitude test was constructed and administered to a sample of 1,926 students, with hypotheses tested using inferential statistics. Results reveal significant disparities in space-related aptitude based on gender, area, and standard, highlighting implications for education policy and teaching strategies. The study underscores the importance of promoting gender equality, improving rural education access, enhancing science programs, and supporting low-achieving students. Additionally, future research avenues in space-related aptitude and educational interventions are discussed to address these disparities comprehensively.

Keywords: space-related aptitude, higher secondary school students, North Gujarat, considering gender, geographical area, and academic standard

INTRODUCTION

Space exploration and astronomy have captured the imagination of humankind for centuries, fueling our curiosity about the universe beyond Earth. In recent years, advancements in technology and space missions have further propelled the interest in these fields. As society strives to unlock the mysteries of space and expand our understanding of the cosmos, it becomes crucial to cultivate a new generation of individuals equipped with the skills and aptitude necessary to contribute to these endeavors.

In the educational context, understanding the factors that influence students' space-related aptitude is of great importance. Various aspects, such as gender, geographical area, and academic standard, may play significant roles in shaping students' abilities, interests, and aspirations in space-related fields. Exploring the relationship between these factors and space-related aptitude can shed light on potential disparities and inform strategies to promote inclusivity and equal opportunities in space science education.

Gender has been a notable factor in discussions surrounding STEM (Science, Technology, Engineering, and Mathematics) disciplines, encompassing space science. Historically, there has been a gender disparity, with fewer women pursuing careers in these domains. Investigating whether differences in space-related aptitude exist between genders can provide insights into potential barriers and opportunities for promoting gender diversity in space-related fields.

Geographical area and cultural contexts can also influence students' exposure to and interest in space science. Students from different regions may have varying access to resources, facilities, and educational opportunities related to space exploration. Understanding the variations in space-related aptitude across geographical areas can help identify areas where targeted interventions and educational programs are needed to bridge the gaps and ensure equal opportunities for all students.

Furthermore, academic standard or grade level can influence students' exposure to space-related concepts, their scientific reasoning abilities, and the complexity of the topics they are exposed to. Exploring how space-related aptitude evolves across different academic standards can provide insights into the development of students' abilities and inform appropriate curriculum design and instructional approaches for different age groups.

This research seeks to address a lack of information in the current body of literature by examining the space-related aptitude of higher secondary school students., considering the unique factors of gender, geographical area, and academic standard simultaneously. By adopting this comprehensive approach, the study seeks to provide a more nuanced understanding of the complexities surrounding students' aptitude in space-related fields.

The practical implications of this study's findings extend to educational practices and policies. Identifying the factors that influence students' space-related aptitude can guide the development of inclusive educational strategies, curriculum enhancements, and career guidance initiatives that foster equal opportunities and encourage students to explore space science. As humanity continues to venture into the vast expanse of space, nurturing the space-related aptitude of future generations becomes essential. The purpose of this research is to make a meaningful contribution to the field by investigating the connection between gender, geographical location, and academic level in influencing the spatial abilities of high school students. Through a comprehensive analysis, the findings of this study will inform educational practices and policies aimed at promoting inclusivity and equal opportunities for all students interested in space-related fields.

VARIABLES

Independent Variables: Gender- Boy & Girls, Standard- 11th & 12th, Area- Rural & Urban

Dependent Variable: Score on Space Relation Aptitude Test.

Controlled Variable: Medium of School- Gujarati

Moderator Variables N.A.

Intervening Variables N.A.

OBJECTIVES

1. To study Space Relation aptitude of Higher Secondary students with respect to gender.
2. To study Space Relation aptitude of Higher Secondary students with respect to area.
3. To study Space Relation aptitude of Higher Secondary students with respect to standard.

HYPOTHESIS

The aim of this research is to examine whether there are significant differences in the mean scores on the Space Relation aptitude test among different groups of higher secondary school students. Specifically, the study investigates the potential differences between boys and girls, students from rural and urban areas, and students studying in standard 11th and 12th.

The null hypotheses for this study are as follows:

There will be no significant difference in the mean scores on the Space Relation aptitude test between boys and girls in higher secondary schools.

There will be no significant difference in the mean scores on the Space Relation aptitude test between students from rural and urban areas studying in higher secondary schools.

There will be no significant difference in the mean scores on the Space Relation aptitude test between students studying in standard 11th and 12th in schools.

By testing these null hypotheses, the study aims to determine whether gender, geographical area, and academic standard have any impact on the mean scores of higher secondary school students on the Space Relation aptitude test. The findings will contribute to understanding potential differences or similarities in space-related aptitude among different student groups and provide insights for educational interventions and policies aimed at enhancing space science education.

Scope of Study

The term "scope" refers to the extent or range of one's abilities, and therefore, the "scope of study" refers to the limits of a study's ability to answer a particular question or problem. In this case, the researcher has defined the scope of the study as follows:

1. The present study is focused on students who are enrolled in Gujarati medium higher secondary schools located in the state of Gujarat and are following the syllabus for higher secondary education that has been designed by the Gujarat Secondary Education Board in Gandhinagar.
2. In the present study Space Ability aptitudes selected to construct test.
3. Researcher tried to measure aptitude with only paper-pencil test.

Significance of the study

The idea that "need is the mother of invention" suggests that inventions arise in response to a need. In India, various studies have been conducted on aptitude, attitude, inelegancy, and the importance of the present study, as listed below:

1. By utilizing Space Ability aptitude tests, secondary school students can assess their aptitude for space-related activities.
2. Obtained measure of Space Ability will help students to choose work place or subjects for further study.
3. Scores of students on Space Ability test will help higher secondary school counselor to provide proper career guidance to their students.
4. These Space Ability test separately or jointly becomes useful as entrance or eligibility test for special course.
5. These Space Ability test may become helpful to teachers for continuous and cumulative evaluation of their students.

Limitations of study

Research serves as a means to arrive at a conclusion regarding truth, although it is important to recognize that truth is an ongoing process that never truly ends. Researchers often find themselves faced with the challenge of exploring a vast array of potential areas to

study, which can make it difficult to cover all the relevant subjects. By focusing on the objectives of the study, researchers are able to establish certain boundaries to achieve the goals of the research. These boundaries, also known as the limitations of the study, are an inherent aspect of every research project. While conducting research, there are often unfavorable circumstances that arise, which may restrict certain activities for the researcher. These constraints or limitations are an essential component of any study and are not something to be ashamed of. The limitations of the present study have been outlined as follows:

1. The study was limited to Gujarati medium higher secondary schools that are governed or affiliated with the Gujarat Secondary Education Board in the state of Gujarat.
2. In the Space Ability test only one types of aptitudes was selected from the noticed aptitudes which were more than 20.
3. Efforts to assess aptitude were limited to a paper-pencil test consisting of multiple-choice questions.
4. The test was administered solely to higher secondary school students from grades 11th and 12th.
5. The study was conducted during the academic year 2021-22, though circumstances may change over time.

RESEARCH METHODOLOGY

TYPE OF RESEARCH

In the present study standardized aptitude test was constructed for higher secondary school going students. It is to be noted that aptitude tests are designed to predict future success in various career fields.

In this present study, an aptitude test was developed in the area of educational assessment and evaluation, with the intention of utilizing it for guidance and counselling purposes. As a result, this research can be considered in the fields of both guidance and counselling, as well as educational assessment and evaluation.

RESEARCH DESIGN

In the present investigation, the researcher designed a test to assess the aptitude of higher secondary school students. The procedures employed in the study unequivocally classify it as a survey. Consequently, this type of research is referred to as survey-type descriptive research.

RESULTS

STATISTICAL TECHNIQUES USED

After application of aptitude test, score of individuals in SPACE RELATION aptitude test was derived. The score was derived from answer sheet used by individual, showing marking for correct answer according to him. Answer Key was prepared and used for scoring. Hypotheses were checked using gathered information.

From result of hypothesis and gathered information, where difference of mean was found significant, according to that norms were established. Gender norms, area norms and standard norms were established for test accordingly.

Frequency distribution was prepared from obtained data. Plotted histogram was compared with normal probability curve using statistical software SPSS-17. Measures of central tendency, measure of deviation, measures of skewness and Kurtosis were calculated. Standard scores T-Score were also derived for test.

TESTING HYPOTHESIS

HYPOTHESIS 1

DESCRIPTIVE ANALYSIS

Statistics		
V1		
N	Valid	1926
	Missing	0
Mean		30.38
Standard Error of Mean		0.123
Median		30.84a
Mode		33
Standard Deviation		5.407
Variance		29.236
Skewness		-0.194
Standard Error of Skewness		0.056
Kurtosis		-0.437
Standard Error of Kurtosis		0.111
Sum		58520

Table 1 : Showing Frequency Distribution Score of students on Space Related Aptitude Test related to gender

The mean, median and mode of stress scores of teachers were 30.38, 30.84 and 33.00 respectively which is in close proximity to each other. The skewness for stress was -0.194 showing the distribution as negatively skewed and value of kurtosis is -0.437 which indicates the curve is platykurtic. The distortion in both the values from normal value were negligible. Therefore, the distribution can be treated as normal

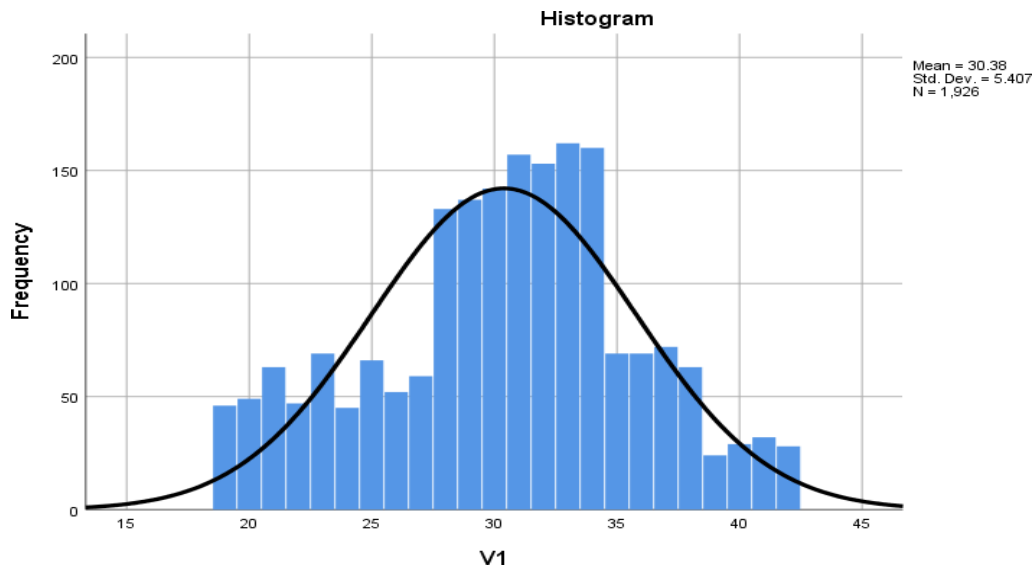


Figure 1 : Showing Frequency Distribution curve of students on Space Related Aptitude Test related to gender

INFERENCE

SERIAL NUMBER	GROUP	N	MEAN	STANDARD DEVIATION	T TEST
1	FEMALE	963	29.32	5.049	8.970
2	MALE	963	31.48	5.543	

The table reveals that the mean score of space related aptitude of female students is 29.32 with STANDARD DEVIATION of 5.049 while the mean score of space related aptitude of male students is 31.48 and STANDARD DEVIATION is 5.543. The difference between the mean score of space related aptitude of male and female students is 2.16. The calculated value of ‘t’ is 8.970 which is higher than the table value is 1.960 for 1924 degrees of freedom at 0.05 level of significance and is significant.

Therefore, the null hypothesis “There is no significant difference in space related aptitude of male and female students” is rejected. It means the space related aptitude is affected by the gender of students.

The mean score of Space related aptitude of Male students is 31.48 which is higher than the mean score of 29.32 compared to the Space related aptitude of Female students. This means that Space related aptitude of Male students is more as compared to the Space related aptitude of Female students

HYPOTHESIS 2

DESCRIPTIVE ANALYSIS

Statistics

V1		
N	Valid	1926
	Missing	0
Mean		30.79
Standard Error of Mean		0.128
Median		31.02a
Mode		30b
Standard Deviation		5.630
Variance		31.700
Skewness		-0.138
Standard Error of Skewness		0.056
Kurtosis		-0.368
Standard Error of Kurtosis		0.111
Sum		59302

Table 2: Showing Frequency Distribution Score of students on Space Related Aptitude Test related to area

The mean, median and mode of stress scores of teachers were 30.79, 31.02 and 30.00 respectively which is in close proximity to each other. The skewness for stress was -0.138 showing the distribution as negatively skewed and value of kurtosis is -0.368 which indicates the curve is platykurtic. The distortion in both the values from normal value were negligible. Therefore, the distribution can be treated as normal

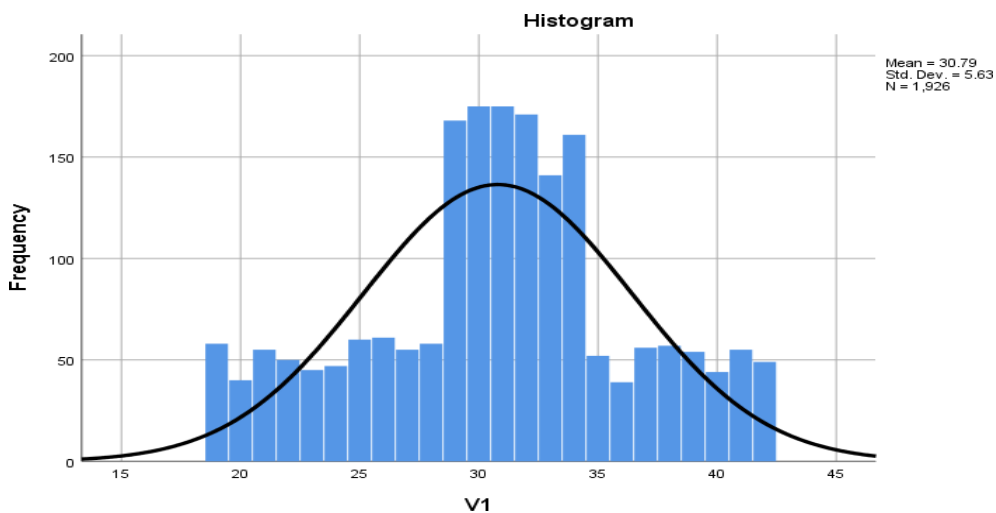


Figure.2: Showing Frequency Distribution curve of students on Space Related Aptitude Test related to area

INFERENCEAL ANALYSIS

SERIAL NUMBER	GROUP	N	MEAN	STANDARD DEVIATION	T TEST
1	URBAN	963	31.08	3.631	2.253

2	RURAL	963	30.50	7.077	
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Table 3: Showing Mean, STANDARD DEVIATION ‘t’ value Space Related Aptitude Test of higher secondary students with respect to area

The table reveals that the mean score of space related aptitude of urban students is 31.08 with STANDARD DEVIATION of 3.631 while the mean score of space related aptitude of rural students is 30.50 and STANDARD DEVIATION is 7.077. The difference between the mean score of space related aptitude of urban and rural Students is 0.58. The calculated value of ‘t’ is 2.253 which is higher than the table value (1.960) for 1924 degrees of freedom at 0.05 level of significance and is significant.

Therefore, the null hypothesis “There is no significant difference in space related aptitude of urban and rural students” is rejected. It means the space related aptitude is affected by the area of students.

The mean score of Space related aptitude of Urban students is 31.08 which is higher than the mean score 30.50 of the Space related aptitude of Rural students. This means that Space related aptitude of Urban students is more as compared to the Space related aptitude of Rural students

HYPOTHESIS 3

DESCRIPTIVE ANALYSIS

Statistics		
V1		
N	Valid	1926
	Missing	6
Mean		30.43
Standard Error of Mean		0.124
Median		30.64a
Mode		29
Standard Deviation		5.446
Variance		29.660
Skewness		-0.076
Standard Error of Skewness		0.056
Kurtosis		-0.338
Standard Error of Kurtosis		0.111
Sum		58601

Table 4: Showing Frequency Distribution Score of students on Space Related Aptitude Test related to standard

The mean, median and mode of stress scores of teachers were 30.43, 30.64 and 29.00 respectively which is in close proximity to each other. The skewness for stress was -0.076 showing the distribution as negatively skewed and value of kurtosis is -0.338 which indicates the curve is platykurtic. The distortion in both the values from normal value were negligible. Therefore, the distribution can be treated as normal.

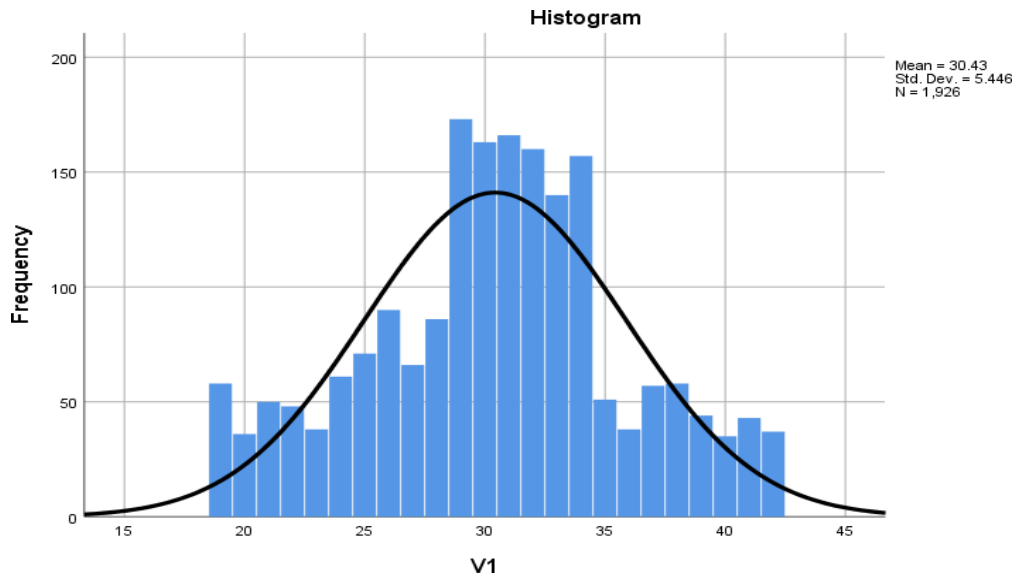


Figure 3: Showing Frequency Distribution curve of students on Space Related Aptitude Test related to standard

INFERENCEAL ANALYSIS

SERIAL NUMBER	GROUP	N	MEAN	STANDARD DEVIATION	T TEST
1	11	963	31.15	4.136	5.862
2	12	963	29.71	6.419	

Table 4: Showing Mean, STANDARD DEVIATION ‘t’ value Space Related Aptitude Test of higher secondary students with respect to standard

The table reveals that the mean score of space related aptitude of 11th students is 31.15 with STANDARD DEVIATION of 4.136 while the mean score of space related aptitude of 12th students is 29.71 and STANDARD DEVIATION is 6.419. The difference between the mean score of space related aptitude of urban and rural Students is 1.44. The calculated value of ‘t’ is 5.862 which is higher than

the table value (1.960) for 1924 degrees of freedom at 0.05 level of significance and is significant.

Therefore, the null hypothesis “There is no significant difference in space related aptitude of 11th and 12th students” is rejected. It means the space related aptitude is affected by the standard of students.

The mean score of Space related aptitude of 11th standard students is 31.15 which is higher than the mean score 29.71 of the Space related aptitude of 12th standard students. This means that Space related aptitude of 11th standard students is more as compared to the Space related aptitude of 12th standard students

DISCUSSIONS

The research paper titled "Exploring the Space-Related Aptitude of Higher Secondary School Students: A Unique Study Considering Gender, Area, and Standard of North Gujarat" aims to investigate the space-related aptitude of higher secondary school students while considering the factors of gender, geographical area, and academic standard. The paper discusses the significance of understanding the factors that impacts the student space-related aptitude and how these factors can contribute to promoting inclusivity and equal opportunities in space science education.

The introduction section provides an overview of the significance of space exploration and astronomy, highlighting the advancements in technology and space missions that have fueled interest in these fields. It emphasizes the need to cultivate a new generation equipped with the skills and aptitude necessary to contribute to space-related endeavors.

The paper identifies gender as a notable factor in STEM fields, including space science, and discusses the historical gender disparity in these domains. It highlights the importance of investigating potential differences in space-related aptitude between genders to identify barriers and opportunities for promoting gender diversity in space-related fields.

Geographical area and academic standard are also identified as factors that can influence students' exposure, interest, and aptitude in space science. The paper emphasizes the significance of understanding the variations in space-related aptitude across geographical areas to ensure equal opportunities for all students.

The objectives of the study are clearly stated, focusing on studying space-related aptitude in relation to gender, area, and standard. The corresponding null hypotheses are provided to test for significant differences in mean scores on the Space Relation aptitude test among different groups of higher secondary school students.

The scope of the study is defined, indicating that it focuses on students studying in Gujarati medium higher secondary schools in the North Gujarat area. The limitations of the study are also acknowledged, including the restricted scope and the use of a paper-pencil test to measure aptitude.

The research methodology section describes the type of research (survey type descriptive research) and the research design employed. The results section presents the statistical techniques used and the findings for each hypothesis tested.

The discussion section, however, is not included in the excerpt provided. Typically, the discussion section of a research paper would interpret and analyze the results, compare them to existing literature, and provide insights into the implications and significance of the findings. It would discuss the limitations of the study and propose avenues for future research.

CONCLUSION

In conclusion, the given study aimed to develop a standardized space related aptitude test for higher secondary school students and to establish its reliability and validity. The study also aimed to investigate the relationship between space related aptitude and various demographic and academic factors. The findings of the study have significant implications for education policy, teaching practices, and future research. The space related aptitude test developed for this study consisted of 45 questions, with a maximum score of 45. The test was administered to a sample of 1,926 students from North Gujarat, India According to the study's findings, male students exhibit higher space-related aptitude than their female counterparts. The same holds true for urban students compared to rural students, and for 11th standard students as opposed to 12th standard students. Additionally, students with higher scholastic achievement demonstrate greater space-related aptitude than those with lower scholastic achievement. These findings have significant implications for educational policy. Firstly, the study highlights the need for promoting gender equality in science and technology fields. The higher space related aptitude scores of male students indicate that female students may be underrepresented in science and technology fields due to a lack of opportunities and resources. Educational policymakers should work towards providing equal opportunities for girls to pursue science and technology education and careers. Secondly, the study emphasizes the importance of improving access to education and resources in rural areas. The lower space related aptitude scores of rural students suggest that students in rural areas may face greater challenges in accessing education and resources. Educational policymakers should work towards improving access to education and resources in rural areas to guarantee that every student have an equal chance to succeed. Thirdly, the study underscores the need for enhancing science education programs. The higher space related aptitude scores of 11th standard students indicate that science education programs may need to be enhanced to ensure that students are well-prepared for these types of tests. Educational policymakers should work towards enhancing science education programs to improve students' space related aptitude. Lastly, the study highlights the need for providing support for low-achieving students. The lower space related aptitude scores of low-achieving students suggest that these students may require additional support and resources to improve their academic performance and achieve better results in these types of tests. Educational policymakers should provide support and resources for low-achieving students to help them improve their academic performance and achieve better results in space related aptitude tests. In addition to the implications for education policy, the findings of this study have significant implications for teaching practices. Teachers can use the results of this study to develop targeted teaching strategies to improve students' space related aptitude. For example, teachers can use interactive and hands-on teaching methods to improve students'

spatial reasoning skills. Teachers can also develop gender-sensitive teaching strategies to ensure that female students receive equal opportunities and resources in science and technology education. The study's outcomes hold significance for future research endeavors. Firstly, future studies can investigate the effectiveness of various teaching strategies and programs to improve students' space related aptitude. Secondly, future studies can investigate the impact of demographic and academic factors on other types of aptitude tests. Lastly, future studies can investigate the relationship between space related aptitude and other academic outcomes such as academic achievement and career choices. The present study provides valuable insights into the relationship between space related aptitude and various demographic and academic factors. The study highlights the need for promoting gender equality in science and technology fields, improving access to education and resources in rural areas, enhancing science education programs, and providing support for low-achieving students. In summary, the present study intended to devise a standardized space-related aptitude examination for higher secondary school students and confirm its reliability and validity. The outcomes of this research have considerable consequences for educational policies, pedagogical techniques, and future investigations. The study also aimed to investigate the relationship between space related aptitude and various demographic and academic factors. The findings of the study have significant implications for education policy, teaching practices, and future research. The space related aptitude test developed for this study consisted of 45 questions, with a maximum score of 45. The test was administered to a sample of 1,926 students from North Gujarat, India. According to the findings of the study, male students exhibit greater spatial aptitude than their female counterparts, and urban students show superior spatial aptitude compared to rural students. Furthermore, the study reveals that 11th standard students possess higher spatial aptitude than 12th standard students, and students with higher scholastic achievement display greater spatial aptitude than those with lower scholastic achievement. These results have significant implications for education policy. Firstly, the study highlights the need for promoting gender equality in science and technology fields. The higher space related aptitude scores of male students indicate that female students may be underrepresented in science and technology fields due to a lack of opportunities and resources. Educational policymakers should work towards providing equal opportunities for girls to pursue science and technology education and careers. Secondly, the study emphasizes the importance of improving access to education and resources in rural areas. The lower space related aptitude scores of rural students suggest that students in rural areas may face greater challenges in accessing education and resources. Educational policymakers should work towards improving access to education and resources in rural areas to ensure that all students have an equal chance to succeed. Thirdly, the study underscores the need for enhancing science education programs. The higher space related aptitude scores of 11th standard students indicate that science education programs may need to be enhanced to ensure that students are well-prepared for these types of tests. Educational policymakers should work towards enhancing science education programs to improve students' space related aptitude. Lastly, the study highlights the need for providing support for low-achieving students. The lower space related aptitude scores of low-achieving students suggest that these students may require additional support and resources to improve their academic performance and achieve better results in these types of tests. Educational policymakers should provide support and resources for low-achieving students to help them improve their academic

performance and achieve better results in space related aptitude tests. In addition to the implications for education policy. Teachers can use the results of this study to develop targeted teaching strategies to improve students' space related aptitude. For example, teachers can use interactive and hands-on teaching methods to improve students' spatial reasoning skills. Teachers can also develop gender-sensitive teaching strategies to ensure that female students receive equal opportunities and resources in science and technology education. Future studies can investigate the effectiveness of various teaching strategies and programs to improve students' space related aptitude. They can also investigate the impact of demographic and academic factors on other types of aptitude tests. Lastly, future studies can investigate the relationship between space related aptitude and other academic outcomes such as academic achievement and career choices. The present study provides valuable insights into the relationship between space related aptitude and various demographic and academic factors. The study highlights the need for promoting gender equality in science and technology fields, improving access to education and resources in rural areas, enhancing science education programs, and providing support for low-achieving students. The findings of this study have significant implications for education policy, teaching practices, and future research.

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