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:
The study aimed to create and validate a standardized space-related aptitude test for higher secondary school students in North Gujarat, India, and to explore its relationship with various demographic and academic factors. The test consisted of 45 questions and was administered to 1,926 students. Key findings include: male students outperformed female students, urban students outscored rural students, 11th standard students had higher aptitude than 12th standard students, and high scholastic students outperformed low scholastic students. These results emphasize the need for gender equality in science fields, enhanced access to resources in rural regions, the refinement of science education programs, and targeted support for low-achieving students. The implications are vast, impacting education policies, teaching methodologies, and guiding future research.

Key words:
Space-related aptitude test, Higher secondary school students, North Gujarat, India, Standardization, Gender equality, Urban vs. rural students, Science education programs, Low-achieving students.

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) fields, including 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 study aims to fill the gap in current research by investigating 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 findings of this study will have practical implications for 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. This study aims to contribute to this endeavor by examining the interplay between gender, geographical area, and academic standard in shaping the space-related aptitude of higher secondary 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 in relation to gender.
  2. To study Space Relation aptitude of Higher Secondary students in relation to area.
  3. To study Space Relation aptitude of Higher Secondary students in relation to standard.

HYPOTHESIS
The aim of this study 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 of this study 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
Scope means range or extent of ability so scope of study means up to which extent present study able to answer. For the present research scope of study stated as,

1. Present study was ranged for students studying in Guajarati medium higher secondary schools of Gujarat state conducting syllabus of higher secondary level framed by Gujarat Secondary Education Board, 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

'Need is the mother of invention', means any invention takes place because of need

In India many researches are carried out on aptitude, attitude, inelegancy, importance of present study are listed as under.

1. With help of these Space Ability aptitude test higher secondary level school going   students can measure their Space Ability aptitudes.
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 is a process to conclude on some truth but, 'truth has no ending.' Looking to wideness of area to research, for researcher it becomes difficult to cover all probable areas concerned with research. In research looking to objectives of research, researcher setting some boundaries to achieve objective of study. Such boundaries are limitations of study.

During research many times unfavorable conditions takes place, because of which some activity could be restricted by researcher. These restrictions or boundaries are called limitations of study. Every work had some limitations and are not a matter of shame.

Limitations for present study were stated as under.

1. Study was limited for Gujarati medium higher secondary school governed or affiliated to Gujarat Secondary Education Board in Gujarat state.
2. In the Space Ability test only one types of aptitudes was selected from the noticed aptitudes which were more than 20.
3. Attempt to measure aptitude was only done by paper-pencil test having multiple choice questions.
4. The test was restricted to higher secondary school standard 11 and 12.
5 The study was performed during academic year 2021-22, but as time passes situation and conditions may vary.

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.

 Thus in present study aptitude test was constructed under area of educational assessment and evaluation with the view point of usage of test for guidance and counseling. So present study likely to consider in research area of: Guidance and Counseling and Educational Assessment and Evaluation.

RESEARCH DESIGN

In present study researcher developed the test which answers what is aptitude of higher secondary school students. Steps followed in research clearly identify it as survey. Thus type of present research is called 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 form 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
Std. Error of Mean		0.123
Median		30.84a
Mode		33
Std. Deviation		5.407
Variance		29.236
Skewness		-0.194
Std. Error of Skewness		0.056
Kurtosis		-0.437
Std. Error of Kurtosis		0.111
Sum		58520
a. Calculated from grouped data.		
b. Multiple modes exist. The smallest value is shown		

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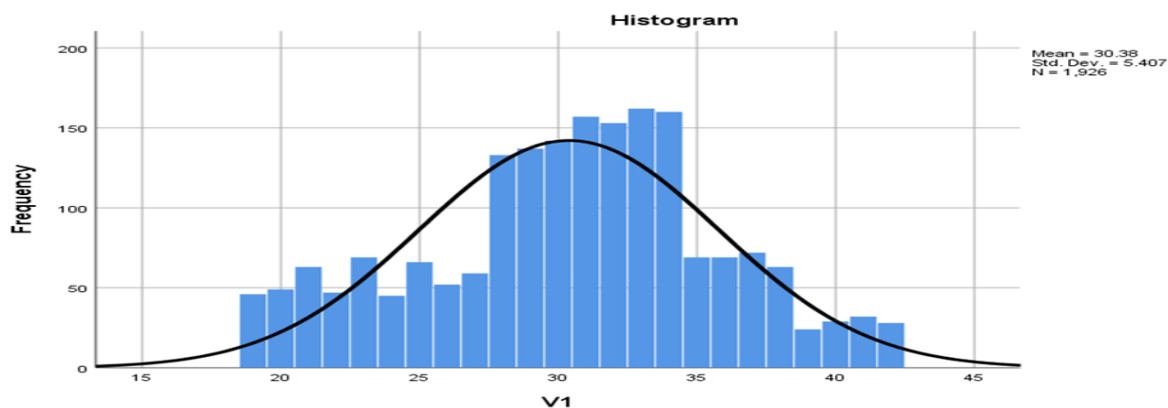
Figure 1 : Showing Frequency Distribution curve of students on Space Related Aptitude Test related to gender

INFERENCE

SR NO	GROUP	N	MEAN	SD	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 S.D. of 5.049 while the mean score of space related aptitude of male students is 31.48 and S.D. 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 (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 29.32 of 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**
Std. Error of Mean		**0.128**
Median		**31.02a**
Mode		**30b**
Std. Deviation		**5.630**
Variance		**31.700**
Skewness		**-0.138**
Std. Error of Skewness		**0.056**
Kurtosis		**-0.368**
Std. Error of Kurtosis		**0.111**
Sum		**59302**
a. Calculated from grouped data.		

b. Multiple modes exist. The smallest value is shown

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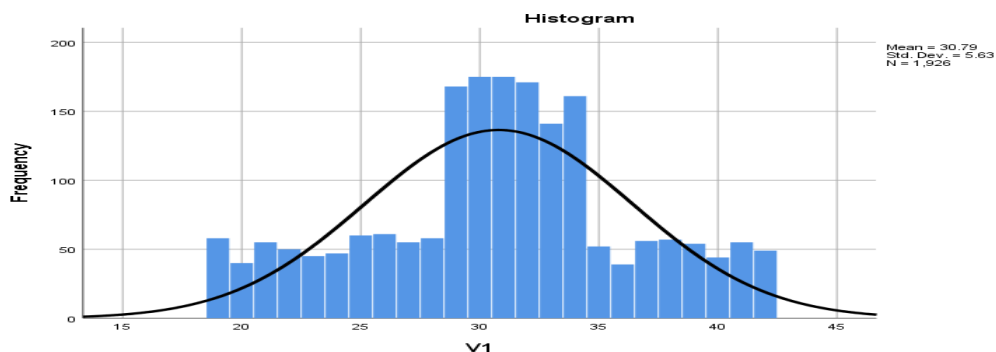
Figure.2: Showing Frequency Distribution curve of students on Space Related Aptitude Test related to area

INFERENTIAL ANALYSIS

SR NO	GROUP	N	MEAN	SD	T TEST
1	URBAN	963	31.08	3.631	2.253
2	RURAL	963	30.50	7.077	

Table 3: Showing Mean, S.D. '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 S.D. of 3.631 while the mean score of space related aptitude of rural students is 30.50 and S.D. 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
Std. Error of Mean		0.124
Median		30.64a
Mode		29

Std. Deviation	5.446
Variance	29.660
Skewness	-0.076
Std. Error of Skewness	0.056
Kurtosis	-0.338
Std. Error of Kurtosis	0.111
Sum	58601
a. Calculated from grouped data.	
b. Multiple modes exist. The smallest value is shown	

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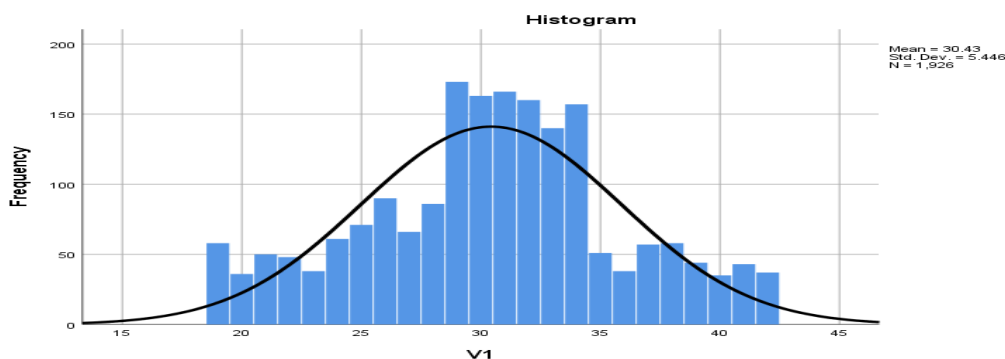
Figure 3: Showing Frequency Distribution curve of students on Space Related Aptitude Test related to standard

INFERENTIAL ANALYSIS

SR NO	GROUP	N	MEAN	SD	T TEST
1	11	963	31.15	4.136	5.862
2	12	963	29.71	6.419	

Table 4: Showing Mean, S.D. '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 S.D. of 4.136 while the mean score of space related aptitude of 12th students is 29.71 and S.D. 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 of11th 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 importance of understanding the factors that influence students' 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 present 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. The results of the study indicate that the space related aptitude of male students is higher than that of female students, the space related aptitude of urban students is higher than that of rural students, the space related aptitude of 11th standard students is higher than that of 12th standard students, and the space related aptitude of high scholastic students is higher than that of low scholastic students. The findings of this study have several 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, 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 findings of this study also have implications for future research. 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. The findings of this study have significant implications for education policy, teaching practices, and future researchIn conclusion, the present 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. 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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 findings of this study also have implications for future research. 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. The findings of this study have significant implications for education policy, teaching practices, and future research.

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