Test of Changing Status in Achievement on Language Subject for Class VII Student: A Study by Mahalanobis Distance

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ABSTRACT

Achievement tests are essential to education because they give teachers important knowledge about the development and talents of their students, assisting them in making decisions about curriculum design, instruction, and educational policy. Main objectives of this study is to determine the change in achievement in different subjects like Bengali, English, and Sanskrit of secondary level student's west Bengal board of secondary Education. It is a Descriptive survey type research. Data for the present study have been accumulated from 200 secondary level school of West Bengal, India using Stratified Random sampling technique. An efficient metric for assessing the dynamical nature of a group of variables is the Mahalanobis distance. Difference dimension of achievement in language (Bengali, English and Sanskrit) are compared taking Gander and institution of various area, as independent variables applying Mahalanobis distance. The result shows that there is no significant difference in dynamical nature of the dichotomous groups when six dependent variables i.e., Bengali Formative, English Formative, Sanskrit Formative, Bengali summative, English Summative, Sanskrit Summative collected as a branch.

Keyword: Mahalanobis Distance, Formative, Summative, Achievement on Language

Introduction

In statistics and data analysis, the Mahalanobis distance is a metric used to express how different two data points are from one another in a multivariate dataset. Given that it considers the correlation between variables, it is especially helpful when working with data in which the variables are not independent. The Mahalanobis Distance values indicate a lack of significant differences, suggesting that the dynamics between the dichotomous groups are quite similar (Das, 2023).

Achievement is a great thing through which a person achieves something when it is an achievement. Achievements can be different for different people, for example those who study, the result is an achievement. Again, for those who dance and sing, it is a kind of achievement to improve their skills. The achievement is different in different cases of people.

Achievement test measures present proficiency, mastery and understanding of general and specific areas of knowledge. Achievement tests attempt to measure what and how individual has learnt, viz. his present standard of performance. A few Scores of achievements indicate the academic status of the individual students in completely different or individually on different subjects. P. C. Mahalanobis developed the Mahalanobis Distance, a new method for comparing two or more variables, in the context of study on racial similarity (Mahalanobis, 1936; Adhikari, 2023). Mahalanobis Distance has previously been used in several research across many different disciplines like Cluster Analysis (Sen et al., 2023a; 2023b; Mohanta et al, 2023a; 2023b; Saha et al., 2021; Gorain et al., 2022; Ansary et al., 2023; Adhikari et al., 2023a; 2023b; Adhikari & Sen, 2023a; 2023b; Ansary, 2023), Mahalanobis Distance is used to compare the difference in achievement analysis (Ahmed et al., 2020; Sen and Pal, 2020; Ahmed et al., 2021; Ahmed et al., 2022a; Ahmed et al., 2022b) as multivariate analysis. Mahalanobis Distance is also used as a measure of multivariate analysis in correlational studies (Saha, 2012; Saha, 2013; Gayen & Sen, 2021; Sutradhar & Sen, 2022; Mahato et al., 2023a; Mahato et al., 2023b; Kundu et al., 2015) etc. The Mahalanobis Distance is one of the most recent innovations in education, notably in a variety of psychological examinations and achievement evaluations.

Review of related Literature

Mohanta, et al. (2023) conducted the study "Comparison among different dimensions of organizational climate of secondary school teachers of West Bengal by Mahalanobis distance." The results demonstrated that the dynamical features of the six dependent variables for different sets of independent variables are not significantly additional. The study "Comparison among self-efficacy, Depression, Anxiety, and Stress of Postgraduate Students by Mahalanobis Distance" was undertaken by Sen et al. in 2023. For this study, three distinct dichotomous groupings of students are taken into account. Five dependent variables—general self-efficacy, specific self-efficacy, depression, anxiety, and stress—are compared using Mahalanobis Distance to see how dynamically they differ. It is discovered that the dynamical nature of five dependent variables for various sets of independent variables is not significantly different. The paper "Application of Mahalanobis distance in education and educational psychology: A review" was done by Adhikari in 2023. This paper examines the Mahalanobis distant research in education and its tremendous potential in educational psychology as of 2020. For conclusions in the context of educational psychology, the combination of components, i.e., internet reliance, social isolation, personality, academic stress, self-efficacy and anxiety, and Mahalanobis distance, is computed. Ahmed et al. (2022) conducted a study "A comparative study on academic achievement of Mathematics and English with other subjects of secondary level in BTR of Assam, India, using Mahalanobis distance" to compare the academic performance of two student groups in the Bodoland Territorial Region (BTR), Assam, India, in the four subject areas of mathematics, English, general sciences, and social studies. When the dynamic nature of achievement of different groups, such as students from tribal and nontribal communities, students from rural and urban schools, tribal boys and nontribal boys, and tribal girls and nontribal girls, is taken into account, the results showed that there is no statistically significant difference between boys and girls. Ahmed et al. (2021) conducted a study "Comparison of achievement of higher secondary subjects among tribal and non-tribal students of Bodoland Territorial Region, Assam, India using Mahalanobis distance" to compare the academic performance of two groups of students from the Bodoland Territorial Region (BTR), Assam, India, in four different subjects: biology, physics, chemistry, and mathematics. Tribal versus non-tribal, males versus girls, and rural versus urban are the three different dichotomous sorts of groups that are created. The dynamical character of achievement for all the aforementioned groups shows no discernible variation. Gorain et al. (2021) conducted a study "A study on internet dependency, social isolation and personality using Mahalanobis distance" to compare many psychological elements such as Internet Dependency, Social Isolation, and five different Personality Factors of Postgraduate Level Students with the use of Mahalanobis Distance and concluded that there are no appreciable disparities in the dynamical nature of male and female students, as well as students studying the arts and sciences. Sen and Pal (2020) conducted a study "Mahalanobis distance: A study on achievement of Science and Mathematics" to study the group performance in arithmetic, physical science, and life science for two student groups, namely seventh grade and eighth grade, in three different types of schools. Mahalanobis Distance is thought to measure the dynamic character of student achievement in three topics for two groups of learners. It has been discovered that in the majority of situations, distances have a substantial impact on how pupils perform in a group of topics. Singh and Praveen (2010) studied the relationship of social maturity with academic achievement of high school students. The study was conducted on a sample of 400 high school students consisting 200 boys and 200 girls studying in tenth class of New Delhi. The aggregate scores of the selected students in the board examinations were taken as the measures of academic achievement. The results indicated that there were no significant differences between the academic achievement of boys and girls. The findings also revealed no significant difference in academic achievement of rural and urban students. Nuthana (2007) carried out a gender analysis of academic achievement of school students of Karnataka. The sample comprised of 600 students including 325 boys and 275 girls. Academic achievement was taken as the average grades of two previous years. The results of study showed that there was no significant difference in academic achievement of boys and girls. But the results indicated a significant difference in academic achievement of urban and rural students with urban students had higher academic achievement than rural counterparts. Khare and Garewal (1996) conducted a study on home environment and academic achievement of elementary school children. The sample comprised of 212 students of middle schools of Bhopal. The results revealed a significant difference in academic achievement of boys and girls. Boys were found to have better academic achievement than girls.

Objectives of the study

Objectives of the study is to compare Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative, Sanskrit Summative and taking together as branch for different groups of secondary schools student as follows:

1. To compare the difference in achievements between Boys and Girls secondary school student regarding the condition of above mentions variables.

2. To compare the difference in achievements between Boys and Co – Educational secondary school students regarding the condition of above mention variables.

3. To compare the difference in achievements between Girls and Co-Educational secondary school students regarding the condition of above mention variables.

Hypothesis of the study

Ho[1] There is no significant difference between Boys and Girls secondary school students on Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative and Sanskrit Summative assessments.

Ho² There is no significant difference between Boys and Co- Educational secondary school students on Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative and Sanskrit Summative assessments.

Ho³There is no significant difference between Girls and Co – Educational secondary school students on Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative and Sanskrit Summative assessments.

Research Methodology

Method of the study: This study conducted through Descriptive Survey Type.

Population of the study: The study is secondary level student's west Bengal.

Sample and sampling of the study: 200 samples are taken through randomly.

Variable of the study

- **Independent Variable** – The independent variable are Boys and girls, Boys and Co- Educational, Girls and Co-Educational.

- **Dependent Variable –** The Dependent variables are Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative and Sanskrit Summative.

Statistical Measure

Step I: Two sets of data for three schools are prepared for calculating the distance. A. For first set of data, learners of seventh grade are considered. Here, scores in three different subjects i.e., Bengali, English and Sanskrit are considered for formative and summative tests.

Step II: Mean, Covariance etc. are calculated for achievement of each subject for different groups because those are required for Mahalanobis Distance (Sen et al., 2023).

Distance (MD) has been calculated by equation:

$$\Delta^2 = (A-B)^T \Sigma^{-1}(A-B)$$

Where A and B are column vectors and Σ is pooled covariance matrix of two groups of data.

$$MD = [(A-B)^T \Sigma^{-1}(A-B)]^{1/2}$$

Pooled Covariance Matrix

$$\Sigma = [n_1 \Sigma_1 + n_2 \Sigma_2]/N$$

Where Σ_1 and Σ_2 be the Covariance Matrices, $n1$ and $n2$ are the sample sizes for first and second group respectively and $N = n_1 + n_2$.

Results and Discussion

Table No-1: Descriptive statistics for various group of students.

Male Students (N=70)						
Dependent variable	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Mean	37.5	35.34	51.61	32.9	36.49	45.36
Female Students (N=69)						
Dependent variable	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Mean	33.46	31.28	48.30	31.55	33.84	40.00
Co- Educational (N=61)						
Dependent variable	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Mean	34.59	30.98	50.21	30.90	34.46	41.13

Table No 2: Pooled Variance Co-variance matrix for Boys and girls

	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Bengali Formative	135.1698	92.41881	84.54286	66.96526	69.91382	96.75006
English Formative	92.41895	143.5964	86.49261	67.38193	77.36711	98.78955
Sanskrit Formative	84.54298	86.49261	159.2342	23.66697	54.5902	133.688
Bengali Summative	66.96548	67.38211	23.66693	122.1936	78.08	67.54426
English Summative	57.44403	55.98286	29.82028	112.4553	158.3091	51.46948
Sanskrit Summative	96.75025	98.78961	133.688	67.54426	64.87224	238.5343

Table No 3: Pooled Variance Covariance matrix for Boys and Co-Educational

	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Bengali Formative	167.9732	132.0262	114.8347	92.03526718	101.9054	135.8624427
English Formative	132.0262	173.4313	141.8438	91.65801527	116.7972	159.2536641
Sanskrit Formative	114.8347	141.8438	187.4716	54.18890585	101.5402	165.4081679
Bengali Summative	92.03547	91.65821	54.18886	151.0956411	93.28934	106.9424162
English Summative	88.67433	94.107	75.25761	129.7638422	143.0394	111.3856997
Sanskrit Summative	135.8626	159.2537	165.4082	106.9424162	125.607	281.3682155

Table no 4: Pooled Variance Covariance Matrix for Girls and Co- Educational

	Bengali Formative	English Formative	Sanskrit Formative	Bengali Summative	English Summative	Sanskrit Summative
Bengali Formative	134.8127128	73.58239	88.78418	47.23347	33.66652	83.02368
English Formative	73.58254902	111.4549	71.0641	48.23683	38.51642	66.65167
Sanskrit Formative	88.78431373	71.0641	179.2696	27.27766	55.08773	136.7443
Bengali Summative	47.23350679	48.23683	27.27766	88.27986	56.37141	37.69894
English Summative	33.66628205	38.51642	55.08773	56.37141	192.2871	24.98895
Sanskrit Summative	83.02377828	66.65167	136.7443	37.69894	24.98895	217.1572

Table No 5: Mahalanobis Distance for three Dependent Variable which is Bengali, English and Sanskrit

Independent Variable	Boys and Girls	Boys and Co-Educational	Girls and Co-Educational
Mahalanobis Distance	0.4579	0.4529	0.0486

Table 5 represents the Mahalanobis Distance of the above mentioned dichotomous variable and the results reveled that there is no significant difference in dynamical nature of the dichotomous groups, when the six dependent variable i.e. Bengali Formative , English Formative , Sanskrit Formative , Bengali Summative , English Summative and Sanskrit Summative collected as a branch . So, H_01, H_02 and H_03 are considered as accepted.

Conclusion

Three different types of school students are considered viz. students studying in Boys School, students studying in Girls School and students studying in Co-educational School. Mahalanobis Distance is used to calculate the distance between a group of dependent variables (Bengali Formative, English Formative, Sanskrit Formative, Bengali Summative, English Summative, and Sanskrit Summative). Mahalanobis Distance indicates that there is no significant difference between the two groups in the results. In conclusion, it may be opined that the students studying in Boys School, Girls School and Co-educational School are equivalent.

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