

Self-Efficacy, Depression, Anxiety and Stress of University Students: A Study by Mahalanobis Distance

Aniket Sutradhar¹, Dr. Subir Sen², Anasuya Adhikari³,
Sukriti Mondal Sutradhar⁴

¹Research Scholar, Department of Education, Sidho-Kanho-Birsha University, Purulia & Assistant Professor, B.Ed. Section, Kalna College, Purba Bardhaman, India

²Associate Professor, Department of Education, Sidho-Kanho-Birsha University, Purulia

³Research Scholar, Department of Education, Sidho-Kanho-Birsha University, Purulia, India

⁴Assistant Professor, Tarasankar Bandyopadhyay B.Ed. Institution, Birbhum, India

Corresponding Author: Aniket Sutradhar

DOI: <https://doi.org/10.52403/gijash.20230302>

ABSTRACT

In the current study, Mahalanobis distance is used to compare the differences between two groups of university students' levels of self-efficacy, depression, anxiety, and stress. Differences between student groups for all dependent variables assessed at once aren't taken into account. Mahalanobis distance is an effective metric for determining a group of variables' dynamical character. 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.

Keywords: General self-efficacy, Specific self-efficacy, Depression, Anxiety, Stress, Mahalanobis distance, University students.

INTRODUCTION

It has been discovered that learners' levels of stress, anxiety, and despair are rising. Self-efficacy is significantly impacted during a pandemic (Gayen and Sen., 2021; Sen et al., 2021). These dependent variables are interconnected, but we can only measure one

of them specifically if we assess each one separately. Therefore, if we measure them both, the results will be more valuable. Such measurements will capture the dynamic nature of the variable group for any dichotomous variable (such as male vs. female). We can use a measure like the Mahalanobis Distance in the current investigation.

Different dimension of survey research in education are Cluster analysis (Mohanta et al., 2023; Sen et al., 2023; Gorain et al., 2022; Ansary et al., 2023; Saha, et al., 2021; Adhikari & Sen, 2023; Adhikari et al., 2023a; Adhikari et al., 2023b), correlational studies (Saha, 2012; Saha, 2013; Gayen & Sen, 2021; Sutradhar & Sen, 2022; Mahato et al., 2023a; Mahato et al., 2023b; Kundu et al., 2015), parametric tests (Ansary et al. 2022; Khan et al, 2023; Khatun et al., 2022; Mahanti et al., 2016; Mondal & Saha, 2017; Mondal et al., 2018; Naik & Sutradhar, 2015; Naik et al., 2015; Roy & Saha, 2022; Roy & Saha, 2023; Roy et al., 2017; Saha, 2012; Saha, 2021) and non-parametric tests (Mahato & Sen, 2021; Haldar et al., 2022; Mahato et al., 2022; Saha & Adhikari, 2021) etc. Mahalanobis Distance is currently used in educational psychology and several metrics of achievement analysis.

LITERATURE REVIEW

Mahalanobis Distance was developed by Prasanta Chandra Mahalanobis in the context of his research on racial resemblance and was first published in 1936. In the works of Rosenbaum (2015), Diedrichsen, Provost, and Zareamoghaddam (2016), Cristani and Murino (2018), Toma (2019), Imani (2019), and Etherington (2019), Mahalanobis Distance was used in a variety of study domains.

Ahmed et al. (2019) studied the difference in achievement in mathematics for different learners in different grades of higher secondary level of Assam, India. The nature of mathematical success for two groups of higher secondary level students is the focus of a study project, according to Ahmed et al. (2020) in their article '*Application of Mahalanobis $\Delta 2$ on Achievement Tests on Mathematics: A Study on Higher Secondary Level Students*'. As per further investigation, Sen and Pal (2020) applied this distance for achievement analysis. Using Mahalanobis Distance achievement in different subjects like Physics, Chemistry, Biology and Mathematics between two groups of students of Bodoland Territorial Region, Assam, India was conducted by Ahmed et al. (2021). Mahato and Sen (2021) have applied the Mahalanobis distance to study academic stress, self-efficacy in mathematics, and anxiety in mathematics for two groups of higher secondary level students.

In their article '*A Study on Internet Dependency, Social Isolation, and Personality using Mahalanobis Distance*', Gorain et al. (2021) have discussed the following topics. Due to its detrimental effects on human personality and potential for social withdrawal, social isolation is a significant element in the development of the internet in the twenty-first century. Utilizing measures like internet dependence, social isolation, and five personality factors, Mahalanobis Distance is used to evaluate the psychological traits of university students.

The article '*A Comparative Study on Academic Achievement of Mathematics and English with Other Subjects of Secondary*

Level in the Bodoland Territorial Region of Assam, India, Using Mahalanobis Distance' by Ahmed et al. (2022a) examines a recent study that contrasts the academic achievements of two student groups in the Bodoland Territorial Region (BTR), Assam, India, in four different subject areas: Mathematics, English, General Sciences, and Social Studies.

Ahmed et al. (2022b) research on the use of the Mahalanobis Distance to compare the academic performance of two groups of higher secondary students in the Bodoland Territorial Region, Assam, India in five different subject areas (Mathematics, English, and other studies).

In another research, 400 secondary level school teachers from West Bengal were studied by Mohanta et al. (2023) using Mahalanobis distance to examine institutional commitment, including affective commitment, professional commitment, commitment to the learner, and academic commitment taken as a unit. They found no significant differences in the dynamic nature of the dichotomous groups when the four dependent variables, namely affective commitment, professional commitment, commitment to the learner, and academic commitment, were taken into consideration.

Sen, Pal, and Adhikari (2023) used the Mahalanobis distance to compare 135 postgraduate students from two groups in terms of their self-efficacy, depression, anxiety, and stress. They discovered that the Mahalanobis distance could accurately compare the two groups of postgraduate students' self-efficacy, depression, anxiety, and stress.

Sen et al. (2023) examined 40 Heads of West Bengal institutions using Mahalanobis distance to examine various leadership styles, including commanding leadership, democratic leadership, visionary leadership, affiliative leadership, and coaching leadership. They found no significant differences in the dynamical nature of the dichotomous groups when five dependent variables, including commanding leadership,

democratic leadership, visionary leadership, and affiliative leadership, were included.

depression, anxiety and stress taken together as a unit.

Objectives

Objectives of this study is to compare general and specific self-efficacy, depression, anxiety and stress taking together as a branch for different group of university students as follows:

1. To compare the difference between male and female students regarding the present condition of above-mentioned variables
2. To compare the difference between first and third semester students regarding the present condition of above-mentioned variables.
3. To compare the difference between students of science departments and social science departments regarding the present condition of above-mentioned variables.

Hypotheses

Following hypotheses may be considered for the present work:

- **H₀₁:** There is no significant difference between male and female students on general and specific self-efficacy, depression, anxiety and stress taken together as a unit.
- **H₀₂:** There is no significant difference between second and fourth semester students on general and specific self-efficacy, depression, anxiety and stress taken together as a unit.
- **H₀₃:** There is no significant difference between students of science departments and social science departments on general and specific self-efficacy,

METHODOLOGY

Descriptive survey method is applied to carry out the research.

Tools used

- The Self-Efficacy Scale: Construction and Validation by Sherer et al. (1995)
- Depression Anxiety & Stress Scales by Lovibond and Lovibond (1995)

Population: Students of Sidho-Kanho-Birsha University, Purulia, West Bengal, India.

Sample: 500 samples are taken randomly.

Variables:

- Independent Variables: Gender (Male and Female), Semester (Second and Fourth) and Department (science and social science)
- Dependent Variables: General Self-efficacy, Specific Self-efficacy, Depression, Anxiety and Stress.

Statistical Measure

Mahalanobis 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.

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

Pooled Covariance Matrix

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

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

RESULTS AND DISCUSSIONS

Table 1: Descriptive statistics for different group of students

Male Students (N=249)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.75	21.93	17.59	145.60	45.00
Female Students (N=251)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.40	20.97	18.29	159.27	44.72
Semester-1 Students (N=231)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.64	20.65	17.46	150.31	46.83
Semester-3 Students (N=269)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.52	22.13	18.35	154.31	43.17

Table no.1continued....					
Students of Social Science Department (N=294)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.70	21.42	17.75	153.39	44.88
Students of Science Departments (N=206)					
Dependent variable	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Mean	20.40	21.49	18.20	151.14	44.83

Table 2: Pooled Variance-Covariance Matrix for Male and Female Students

	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Stress	26.21	3.70	6.31	-1.24	6.60
Anxiety	3.70	38.31	15.99	-15.13	-10.80
Depression	6.31	15.99	57.67	-35.11	-18.51
General Self-efficacy	-1.24	-15.13	-35.11	1232.68	96.24
Specific Self-efficacy	6.60	-10.80	-18.51	96.24	137.92

Table 3: Pooled Variance-Covariance Matrix for Semester-1 and Semester-3 Students

	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Stress	26.24	3.83	6.28	-2.33	6.52
Anxiety	3.83	37.99	15.49	-19.93	-9.37
Depression	6.28	15.49	57.60	-33.59	-17.76
General Self-efficacy	-2.33	-19.93	-33.59	1275.56	98.91
Specific Self-efficacy	6.52	-9.37	-17.76	98.91	134.61

Table 4: Pooled Variance-Covariance Matrix for Social Science and Science department Students

	Stress	Anxiety	Depression	General Self-efficacy	Specific Self-efficacy
Stress	26.23	3.79	6.29	-2.62	6.62
Anxiety	3.79	38.55	15.82	-18.39	-10.73
Depression	6.29	15.82	57.75	-32.45	-18.56
General Self-efficacy	-2.62	-18.39	-32.45	1278.28	95.22
Specific Self-efficacy	6.62	-10.73	-18.56	95.22	137.93

Table 5: Mahalanobis Distance for three dependent variables general self-efficacy, specific self-efficacy, depression, anxiety and stress

Independent variables	Male vs Female	Semester-1 vs Semester-3	Social Science Department vs Science Departments
Mahalanobis Distance	0.4726	0.4267	0.1113

Values of Mahalanobis Distance listed in Table 5 express that the differences are insignificant. So, there is no significant difference in dynamical nature of the dichotomous groups when five dependent variables general self-efficacy, specific self-efficacy, depression, anxiety and stress composed as a branch. So, H_{01} , H_{02} and H_{03} are accepted.

CONCLUSION

A partial attribution of the current state may be made if we take the detection of one variable into account individually. Researchers can measure a group of dependent variables considering as a branch attribution by Mahalanobis Distance detects the overall dynamical nature of the present state. In present study we found no significant differences between groups as result one may conclude that dynamical nature of the five dependent variables taken at a time are similar.

REFERENCES

- Adhikari, A. & Sen, S. (2023). Cluster Analysis on Institutional Commitment and Organizational Climate. *International Journal of Research Publication and Reviews*, 4(5), 4974-4988.
- Adhikari, A. (2022). Socio-Educational Perspectives: A Study on Human Adjustment. *EPRA International Journal of Research & Development (IJRD)*, 8(1), 97-101.
- Adhikari, A. (2023). Application of Mahalanobis distance in education and educational psychology: A review. *Innovare Journal of Education*, 11(4). In Press.
- Adhikari, A. (2023a). Socio-educational perspectives: A study on human adjustment. *EPRA International Journal of Research and Development*, 8(1), 97-101.
- Adhikari, A., Gayen, P., Mahato, R. C., Pal, I., & Sen, S. (2023). Multi-dimensional data analysis in education: Accumulation and comparison among variables. *International Journal of Research Publication and Reviews*, 4(5), 2243-2245.

6. Adhikari, A., Gayen, P., Sutradhar, A. & Sen, S. (2023). A Measure for Measure: Statistics in Education. *International Journal of Research Publication and Reviews*. 4(5). 4239-4243.
7. Adhikari, A., Gayen, P., Mahato, R.C., Pal, I. & Sen, S. (2023). Multi-Dimensional Data Analysis in Education: Accumulation and Comparison among Variables. *International Journal of Research Publication and Reviews*. 4(5). 2243-2245.
8. Adhikari, A., Gorain, S.C., Gayen, P., Pal, I. & Sen, S. (2023b). Studying the Differences: A Review on t-Test. *International Research Journal of Education and Technology*. 5(5). 338-349.
9. Adhikari, A., Mahato, R.C., Gorain, S.C. & Sen, S. (2023a). Review On Parametric and Non-Parametric Test in Education. *International Journal of Research and Analytical Reviews (IJRAR)*. 10(2). 796-801.
10. Ahmed, E. A., Banerjee M., Sen, S., Chatterjee P. (2020). Application of Mahalanobis Δ_2 on achievement tests on Mathematics: a study on higher secondary level students. *Indian Journal of Psychology and Education*, 10(1), 36-40.
11. Ahmed, E. A., Banerjee, M., Sen, S. & Chatterjee, P. (2021). Comparison of achievement of higher secondary subjects among tribal and non-tribal students of Bodoland Territorial Region, Assam, India using Mahalanobis distance. *Journal of Calcutta Mathematical Society*, 17(1) 61–66.
12. Ahmed, E. A., Karim M. R., Banerjee M., Chatterjee P, Mandal G. (2022a). A comparative study on academic achievement of Mathematics and English with other subjects of secondary level in BTR of Assam, India using Mahalanobis distance, *Education Research International*, 1-10. <https://doi.org/10.1155/2022/3669065>
13. Ahmed, E. A., Karim, M. R., Banerjee, M. & Sen S. (2022). Comparison of scholastic attainment in English and Math amongst other studies at the higher secondary level: A study using mahalanobis distance. *Kuramve Uygulamada Eğitim Yönetimi Educational Administration: Theory and Practice*, 28(4), 1-13.
14. Ansary, A., Ansary, S., Adhikari, A. & Sen, S. (2023). Clustering Technique for Analyzing Attitude towards Value-oriented Education among Undergraduate Students. *International Journal of Research Publication and Reviews*. 4(5). 5576-5584.
15. Ansary, S., Ansary, K. & Adhikari, A. (2022). Attitude towards Social Adjustment among the Undergraduate Students of Purulia District. *EPRA International Journal of Research and Development (IJRD)*. 7(12), 21-26.
16. Ansary, S., Ansary, K., & Adhikari, A. (2022). Attitude towards social adjustment among the undergraduate students of Purulia District. *EPRA International Journal of Research and Development*, 7(12), 21-26. <https://doi.org/10.36713/epra119307>
17. Cristani, M. & Murino V. (2018). Person re-identification, image and video processing and analysis and computer vision. *Academic Press Library in Signal Processing*, 6, 365-394.
18. Diedrichsen, J., Provost, S. & Zareamoghaddam, H. (2016). On the distribution of cross validated Mahalanobis distances.
19. Etherington, T. R. (2019). Mahalanobis distances and ecological niche modelling: correcting a chi-squared probability error. *PeerJ*, 66-78. <http://doi.org/10.7717/peerj.6678>
20. Gayen, P. & Sen, S. (2021). Prevalence of anxiety, depression and stress among postgraduate students during COVID-19 situation: A study on postgraduate students. *International Journal for Innovative Research in Multidisciplinary Field*, 7(9), 172- 178.
21. Gayen, P., & Sen, S. (2021). Prevalence of anxiety, depression and stress among postgraduate students during COVID-19 situation: A study on postgraduate students. *International Journal for Innovative Research in Multidisciplinary Field*, 7(9), 172- 178.
22. Gayen, P., Sen, S. and Adhikari, A. (2023). Relationship between Organizational Climate and Institutional Commitment of Secondary School Teachers of West Bengal. *International Journal of Scientific Research and Engineering Development*. 6(3). 426-435.
23. Gorain, S. C., Adhikari, A., Saha, B. & Sen, S. (2021). A study on internet dependency, social isolation and personality using Mahalanobis distance, *EPRA International Journal of Research and Development*, 6(9),

- 179–184. .
<https://doi.org/10.36713/epra8471>
24. Gorain, S. C., Mondal, A., Ansary, K. & Saha, B. (2018). Social isolation in relation to internet usage and stream of study of under graduate students. *American Journal of Educational Research*, 6(4), 361-364.
25. Gorain, S. C., Saha, B., Maji, S. & Sen, S. (2022). A study on relationship and cluster analysis among internet dependency, social isolation and personality. *International Journal of Research Publication and Reviews*, 3(1), 884-888.
26. Halder, P., Roy, S., Gorain, S. C., Adhikari, A., & Saha, B. (2022). Measuring attitude towards sustainable development among trainee teachers in Purulia district of West Bengal, *American Journal of Educational Research*, 10(12), 682-696. <https://doi.org/10.12691/education-10-12-5>
27. Halder, P., Roy, S., Gorain, S.C., Adhikari, A. & Saha, B. (2022). Measuring Attitude towards Sustainable Development among Trainee Teachers in Purulia District of West Bengal. *American Journal of Educational Research*. 10(12), 682-696.
28. Imani, M. (2019). Difference-based target detection using Mahalanobis distance and spectral angle. *International Journal of Remote Sensing*, 40(3), 811-831.
29. Kar, D. & Saha, B. (2021). A study of relationship between leadership style and emotional intelligence of undergraduate students. *International Journal of Research and Analytical Reviews*, 8(2), 13-15.
30. Kar, D. & Saha, B. (2021). Leadership style and Adjustment Ability among Undergraduate Students: A Correlational Study. *International Journal of Creative Research Thoughts*, 9(9), d148-d151.
31. Kar, D., Saha, B., & Mondal, B. C. (2016). Emotional Intelligence and Adjustment Ability among Higher Secondary School Students: A correlational study. *American Journal of Social Sciences*, 4(4), 34-37.
32. Karmakar, T., Paul, A., Mondal, A. & Saha, B. (2016). Intelligence in relation to Height and Weight among Secondary School Students. *American Journal of Educational Research*, 4(16), 1145-1148.
33. Khan, S., Roy, S., Gorain, S. C., & Adhikari, A. (2023). Cyber schooling: a study on the higher education learners. *IAR Journal of Humanities and Social Science*, 4(1), 1-10. <https://doi.org/10.47310/iarjhss.2023.v04i01.00118>
34. Khatun, S., Ansary, K., & Adhikari, A. (2022). Attitude towards yoga education among undergraduate students. *EPR International Journal of Multidisciplinary Research*, 8(12),9-13. <https://doi.org/10.36713/epra1193119>
35. Kundu, M., Saha, B. & Mondal, B. C. (2015). Adjustment of undergraduate students in relation to their Social Intelligence. *American Journal of Educational Research*, 3(11), 1398-1401.
36. Kundu, M., Saha, B., & Mondal, B. C. (2015). Adjustment of undergraduate students in relation to their Social Intelligence. *American Journal of Educational Research*, 3(11), 1398-1401.
37. Lovibond, S. H. & Lovibond, P. F. (1995). Manual for the depression anxiety & stress scales. (2nd Ed.) Sydney: Psychology Foundation. Retrieved from <https://maic.qld.gov.au/wp-content/uploads/2016/07/DASS-21.pdf>
38. Mahalanobis, P. C. (1936). On the generalized distance in statistics. proceedings of the national institute of sciences of India, 2(1), 49-55.
39. Mahanti, J., Mondal, B.C., & Saha, B. (2016). Internet dependency of undergraduate students: an empirical study. *American International Journal of Research in Humanities, Arts and Social Sciences*, 15(2), 171-174.21.
40. Mahato, A., Gayen, P. & Mahato, R. (2023c). Relationship between Cognitive Failure and Internet Addiction of Higher Secondary Students of Purulia District of West Bengal: A Study. *Innovare Journal of Education*, 11(3), 15-19.
41. Mahato, A., Gayen, P. & Mahato, R. C. (2023b). Relationship between academic resilience and internet addiction of undergraduate students of Purulia district of West Bengal: A study. *EPR International Journal of Multidisciplinary Research*, 9(3), 103-106.
42. Mahato, A., Gayen, P., & Mahato, R. C. (2023b). Relationship between academic resilience and internet addiction of undergraduate students of Purulia district of West Bengal: A study. *EPR International Journal of Multidisciplinary Research*, 9(3), 103-106.

43. Mahato, D., Gorain, S. C., Roy, S., & Adhikari, A. (2022). Introspecting flipped classroom: a survey on higher education students. *Galore International Journal of Applied Sciences and Humanities*, 6(4), 56-69.
<https://doi.org/10.52403/gijash.20221009>
44. Mahato, M., Gayen, P. & Mahato, R. C. (2023a). Relationship between self-efficacy and m-learning of undergraduate students of Purulia district of West Bengal. *International Journal of Research Publication and Reviews*, 4(4), 3219-3222.
45. Mahato, M., Gayen, P., & Mahato, R. C. (2023a). Relationship between self-efficacy and m-learning of undergraduate students of Purulia district of West Bengal. *International Journal of Research Publication and Reviews*, 4(4), 3219-3222.
46. Mahato, R. C. & Sen, S. (2021). Application of Mahalanobis distance to determine the dynamical nature of academic stress, self-efficacy in mathematics and anxiety in mathematics. *International Journal of Advances in Engineering and Management*, 3(5), 1398-1401.
47. Mahato, R. C. & Sen, S. (2023). Relationship among Contexts Knowledge (CK1), technological pedagogical content knowledge (TPCK) and attitude towards creative teaching for pre-service trainee teachers: A study on Mathematics method subject. *International Journal of Creative Research Thoughts*, 11(4), d301-d314.
48. Mahato, R. C., & Sen, S. (2021). Academic stress, self-efficacy and anxiety: A study on Mathematics of higher secondary level students in Purulia district of West Bengal, India. *International Journal of Creative Research Thoughts*, 9(5), c969-c980.
49. Mohanta, R., Adhikari, A., Pal, I., & Sen, S. (2023). Introspecting institutional commitment using cluster analysis. *International Research Journal of Education and Technology*, 5(4), 198-217.
50. Mohanta, R., Adhikari, A., Pal, I., & Sen, S. (2023). Introspecting Institutional Commitment Using Cluster Analysis, *International Research Journal of Education and Technology*. 5(4), 198 – 217
51. Mohanta, R., Gayen, P., Pal, I., Mahato, R. C. & Sen, S. (2023). Comparison among different dimensions of organizational climate of secondary school teachers of West Bengal by Mahalanobis distance. *EPRA International Journal of Research and Development (IJRD)*, 8(4),129 – 133.
52. Mohanta, R., Gayen, P., Pal, I., Sutradhar, A. & Sen, S. (2023). Comparison among different dimensions of institutional commitment of secondary school teachers of West Bengal by Mahalanobis Distance. *International Research Journal of Modernization in Engineering Technology and Science*. 5(4). 4088-4093.
53. Mohanta, R., Sen, S., Adhikari, A. & Pal, I. (2023). Perceptual Environment: A Study on Organizational Climate Using Cluster Analysis. *International Journal of Research Publication and Review*. 4(4). 1336 – 1346.
54. Mondal, A. & Saha, B. (2017). Job satisfaction of secondary school teachers in relation to personality and emotional intelligence. *American Journal of Educational Research*, 5(10), 1097-1101.
<https://doi.org/10.12691/education-5-10-11>
55. Mondal, A., Ansary, K., Gorain, S. C. & Saha, B. (2018). Internet Affinity in relation to Personality and Gender. *American International Journal of Research in Humanities, Arts and Social Sciences*, 22(1), 11-15.
56. Mondal, A., Ansary, K., Gorain, S. C., & Saha, B. (2018). Internet affinity in relation to personality and gender. *American International Journal of Research in Humanities, Arts and Social Sciences*, 22(1), 11-15.
57. Naik, P. K., & Sutradhar, A. (2015). Impact of emotional maturity on personality of B.Ed. trainees: a study. *Asian Academic Research Journal of Social Science & Humanities*, 2(1), 1-10.
58. Naik, P. K., Dutta, A. N. & Sutradhar, A. (2015). Mental health of Facebook addicted and non-addicted adolescent students-a study. *Journal of International Academic Research for Multidisciplinary*, 3(5),352-358.
59. Naik, P. K., Dutta, A. N., & Sutradhar, A. (2015). Mental health of Facebook addicted and non-addicted adolescent students-a study. *Journal of International Academic Research for Multidisciplinary*, 3(5), 352-358.
60. Rosenbaum, P. R. (2015). Observational studies: Overview. James D. Wright (eds.), *International Encyclopaedia of the Social & Behavioral Sciences*, 2, 107-112.

61. Roy, S. & Saha, B. (2022). Achievement motivation of post graduate level students: an analytical study. *Galore International Journal of Applied Sciences and Humanities*, 6(4), 51-55. <https://doi.org/10.52403/gijash.2022100837>
62. Roy, S. & Saha, B. (2023). Exploring the self-concept of post graduate level students: a critical study. *International Journal of Research and Review*, 10(1), 372-377. <https://doi.org/10.52403/ijrr.2023014138>
63. Roy, S., Saha, B. & Maji, S. (2017). Measuring attitude towards inclusive education among B.Ed. students in Purulia district of West Bengal. *Conflux Journal of Education*, 5(7), 37-43.
64. Saha, B. & Adhikari, A. (2021). Measuring Social Relationship of Undergraduate College Students of West Bengal. *Education India Journal: A Quarterly Refereed Journal of Dialogues on Education, A UGC CARE List Journal*. 10(4). 261-269.
65. Saha, B. (2012). A comparative study of environmental awareness among teacher trainees of West Bengal. *Indian Streams Research Journal*, 2(9), 1-5.
66. Saha, B. (2012). Creativity in relation to Socio-economic Status in Secondary School Students in West Bengal. *Indian Journal of Applied Research*, 2(2), 60-61.
67. Saha, B. (2012). Creativity in relation to Socio-economic Status in Secondary School Students in West Bengal. *Indian Journal of Applied Research*, 2(2), 60-61.
68. Saha, B. (2013). Creativity in Relation to Environmental Awareness in Birbhum District: An Analytical Study. *IJSR-International Journal of Scientific Research*, 2(8), 106-107.
69. Saha, B. (2013). Creativity in Relation to Environmental Awareness in Birbhum District: An Analytical Study. *IJSR-International Journal of Scientific Research*, 2(8), 106-107.
70. Saha, B. (2021). Attitude towards yoga practice among college students with regard to gender, residence and stream of study. *IAR Journal of Humanities and Social Science*, 2(5), 25-29.
71. Saha, B. Adhikari, A. (2021). Measuring social relationship of undergraduate college students of West Bengal. *Education India Journal*, 10(4). 261-269.
72. Saha, B. Sen, S. & Adhikari, A. (2021). Analysis of Attitude Towards Yoga Among College Students Using Clustering Techniques, *EPRA International Journal of Multidisciplinary Research (IJMR)*. 7(9). 308 – 314.
73. Saha, B., Sen, S & Adhikari, A. (2021). Analysis of attitude towards yoga among college students using clustering techniques. *EPRA International Journal of Multidisciplinary Research*, 7(9), 308-314. <https://doi.org/10.36713/epra8552>
74. Sen, S. & Pal, I. (2020) Mahalanobis distance: A study on achievement of science and mathematics. *International Journal of Creative Research Thoughts*, 8(7), 2542-2547.
75. Sen, S. and Adhikari, A. (2023). Cluster Analysis on Institutional Commitment and Organizational Climate. *International Journal of Research Publication and Reviews*. 4(6). 4974-4988.
76. Sen, S., Adhikari, A., Ansary, K., Roy, S. & Pal, I. (2023). Clustering technique for analyzing leadership style of the head of the institutions. *International Journal of Advanced Research in Science, Communication and Technology*, 3(3), 220-228.
77. Sen, S., Adhikari, A., Ansary, K., Roy, S. & Pal, I. (2023). Clustering technique for analyzing leadership style of the head of the institutions. *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)*, 3(3), 220 – 228.
78. Sen, S., Gayen, P., Mahato, R.C. and Adhikari, A. (2023). A Correlational Study on Organisational Climate and Institutional Commitment of Secondary School Teachers. *International Journal of Multidisciplinary Research and Publications*. 5(12). 152-155.
79. Sen, S., Gayen, P., Pal, I., Sutradhar, A., Ansary, K., Mahato, R. C., & Adhikari, A. (2023). Comparison among different leadership styles of head of the institution of West Bengal by Mahalanobis distance. *International Research Journal of Modernization in Engineering Technology and Science*, 5(4), 5005-5010.
80. Sen, S., Gayen, P., Pal, I., Sutradhar, A., Ansary, K., Mahato, R.C. & Adhikari, A. (2023). Comparison among different leadership styles of head of the institution of West Bengal by Mahalanobis distance. *International Research Journal of*

- Modernization in Engineering Technology and Science*, 5(4), 5005-5010.
81. Sen, S., Pal, I., & Adhikari, A. (2023). Comparison among self-efficacy, Depression, Anxiety and stress of postgraduate students by Mahalanobis distance. *International Journal of Advanced Education and Research*, 8(1), 85-88.
82. Sen, S., Sau, P., Mahato, S., Satpati, S., Afreen, T. & Gayen, P. (2021). Depression, Anxiety and Stress of Postgraduate Students during Covid-19 Pandemic: A Study on Postgraduate Students of Sidho-Kanho-Birsha University, Purulia, West Bengal, India. *International Journal of Research Publication and Reviews*. 2(9). 586-591.
83. Sherer, M. et al. (1982). The self-efficacy scale: Construction and validation. *Psychological Reports*, 51, 663-671.
84. Sherer, M., Maddux, J. E., Mercandante, B., Prentice-Dunn, S., Jacobs, B., Rogers, R. W. (1982). The self-efficacy scale: construction and validation. *Psychological Reports*, 51(2), 663-671.
<https://doi.org/10.2466/pr0.1982.51.2.663>
85. Sutradhar, A., & Sen, S. (2022). Effect of Different Dimensions of Emotional Maturity on Academic Achievement of B. Ed. Trainees—A Study. *International Journal of Research Publication and Reviews*, 3(11), 1237-1247.
86. Sutradhar, A., & Sen, S. (2022). Emotional maturity and study habits of B. Ed. trainees—A correlational study. *International Journal of Multidisciplinary Research and Development*, 9(12), 77-83.
87. Sutradhar, A., Adhikari, A., Sutradhar, S.M. & Sen, S. (2023). Use of Correlation in Educational Research. *International Research Journal of Education and Technology*. 5(5). 731-737.
88. Thomas, R., & Etherington E. R. (2019). Mahalanobis distances and ecological niche modelling: Correcting a chi-squared probability error. *PeerJ*, 7:e6678 .
<https://peerj.com/articles/6678/>
89. Toma, E. (2019). Analysis of motor fan radiated sound and vibration waveform by automatic Pattern recognition technique using “Mahalanobis distance”. *Journal of Industrial Engineering International*, 15(1), 81-92.

How to cite this article: Aniket Sutradhar, Subir Sen, Anasuya Adhikari et.al. Self-efficacy, depression, anxiety and stress of university students: a study by Mahalanobis distance. *Galore International Journal of Applied Sciences & Humanities*. 2023; 7(3): 7-15. DOI: <https://doi.org/10.52403/gijash.20230302>
