*The Social Science Review A Multidisciplinary Journal. May-June, 2025. Vol. 3. Issue 3. 72-85*

*Published by: Pather Dabi Educational Trust, (Regn No: IV-1402-00064/2023), Under Govt. of West Bengal, India*

The Social Science Review
A Multidisciplinary Journal
ISSN: 2584-0789
(Open-Access, Peer-Reviewed, Refereed, Bi-Monthly, International e-Journal)
Homepage: www.tssreview.in

# CLUSTERING OF POSTGRADUATE STUDENT'S COGNITIVE TEST ANXIETY (CTA)

Shankar Mondal [1] & Surajit Mahato [2]

**RESEARCH ARTICLE**

**Author Details:** [1] Research Scholar, Department of Education, Sidho-Kanho-Birsha University, Purulia, West Bengal, India; [2] Research Scholar, Department of Education, Sidho-Kanho-Birsha University, Purulia, West Bengal, India

**Corresponding Author:**
Surajit Mahato

**DOI:**
https://doi.org/10.70096/tssr.250303014

**Abstract**

In psychology, anxiety is one of the most common phenomena that has long been studied. Cognitive Test Anxiety is the term used to describe the emotional and psychological reactions people have when they are about to take an exam or test. The objective of this study is to identify the cluster using research variables-gender, stream, residence and CTA (Cognitive Test Anxiety) for assessing predictor significance in cluster formation. To achieve those objectives the researcher used a descriptive survey approach and took 363 arts and science postgraduate students from Sidho-Kanho-Birsha University as sample. As a statistical technique, the researcher has used a two-step clustering approach to classify the entire sample into distinct clusters. Variables such as residence, gender and stream were identified as contributors to distinct clusters and their influence on CTA. The study's conclusions showed that as the clusters grow, from 2 to 10 clusters the residence, gender, stream and CTA as predictors become highly significant. Therefore, it can be opined that change of predictors with respect to residence and gender are very high, stream is mediocre, and CTA is low for small clusters but becomes high for large number of clusters.

**Keywords:** *Cognitive Test Anxiety, Clustering, Postgraduate, Residence, Gender, Stream*

## Introduction

Test anxiety is the term used to characterise student's concern and panic over their capacity to perform well in a test (Bakete et al., 2023). Anxiety is one of the most prevalent phenomena in psychology and has been researched for a long time. Anxiety is a common reaction to stress and is a fundamental human emotion that denotes a lack of confidence or a sense of danger from the environment (Sarason, 1984). In the middle of 20th century, the idea of "Cognitive Test Anxiety" gained popularity in psychology, with early research on the relationship between cognitive and performance test anxiety published in 1950 by Sarason and Mandler. These definitions define test anxiety as a person's subjective response to taking tests and exams. This involves concern about the consequences of failing an exam and the likelihood of doing so. Repercussions include psychological hyperarousal, negative thought patterns, a desire to avoid evaluate situations, poor exam performance, and difficulty focusing on the task at hand (Mondal, 2025).

Data clustering is a statistical and unsupervised data analysis method. It is employed to group similar data into a homogenous category. It is also useful for working with big data sets to find hidden patterns and relationships that aid in speedy and effective decision-making. To put it simply, cluster analysis divides a big collection of data into smaller groups known as clusters. Data items that are similar to one other and stored within the same cluster but different from objects in other clusters make up each cluster (Shovon & Haque, 2012). This analysis may be applied to both continuous and categorical data and is appropriate when there are three or more categories in the categorical variables (Zhang et al., 1996). The count of clusters may be chosen or determined via the two-step cluster analysis technique. The grouping step, which forms the basis of the analysis, involves sorting the subclusters into the necessary number of clusters. There are fewer sub-clusters than data, making it easy to employ conventional grouping methods. The more subclusters there are, the more accurate the method is (Sen et al., 2023).

## Review of Related Literatures

Cassady and Johnson (2002) have investigated the connection between cognitive test anxiety and academic achievement. The results confirmed the notion that cognitive test had a important, constant, and detrimental influence on academic achievement metrics and were in line with theories of test anxiety related to cognitive appraisal information processing. Lufi and Darliuk (2005) investigated the connection between teen's exam anxiety and learning disabilities (LD). It was anticipated that the verbal IQ of the LD group would be lower than that of the non-LD groups. The study also found that teens with test anxiety did not substantially differ in their personalities according on LD. Furlan et al. (2009) spearheaded the effort to change the university

student's cognition exam anxiety scale. The results of the study demonstrated the use of the scale utilised in the study for future cross-culture research on test anxiety in Argentinean and American students. Putwain et al. (2010) examined how cognitive biases effect the relationship between test anxiety and exam performance. The results supported a paradigm in which academic achievement and two types of test anxiety worry, physical signs and symptoms were entirely mediated academic domain-related cognitive distortions. Facca & Allen (2011) studied on cluster analysis can be helpful tool for leadership educators in classifying students based on their self-reported emotionally intelligent leadership behaviours. This allowed programme architects to create interventions that are more specially tailored to each student's needs. Saha (2012) conducted in order to compare the environmental awareness of West Bengal teacher candidates. The results demonstrated that there is no appreciable difference in the level of environmental awareness between male and female teacher candidates, and that pre-service and humanities teacher candidates are less knowledgeable than in-service and scientific teacher candidates. Yang (2012) carried out to investigate college student's opinions and self-efficacy on the usage of m-learning devices in a task-based language course. The results showed that most students had positive thoughts about m-learning and thought it had made them more eager to learn English. Akinsola and Nwajei (2013) led on test anxiety, depression, and academic performance. The study found no appreciable variation in test anxiety levels between males and females, and there was a significant and substantial correlation between test anxiety, trait anxiety, and depression. Mondal and Saha (2013) carried out a comparative study of the differences in scientific achievement amongst secondary schools in Darjeeling district. The results demonstrated that male and female students had significantly different performance levels in secondary science courses, and that male students from rural and urban areas performed significantly differently in secondary science courses. Rana and Mahmood (2013) assessed the degree of test anxiety among Pakistani graduate and postgraduate students. The results showed a significant negative correlation between test anxiety levels and academic achievement among Pakistan university students. Sen, Mondal and Saha (2013) conducted study in the Birbhum district of West Bengal in order to compare and provide certain facts and causes about the low achievement in physics at the higher secondary level in relation to the science group at the secondary level. The results demonstrated a significant gap between secondary and higher secondary student's science proficiency.

Kar, Saha and Mondal (2014) conducted research to see how West Bengal's students felt about online learning. The findings showed that students had a favourable attitude toward online education and that their attitude rating was not significantly impacted by their region, gender, and stream. Kar, Saha and Mondal (2014a) focused on secondary school student's emotional intelligence in relation to their gender and home environment. The findings indicated that although home environment has a substantial impact on the expansion of emotional development and gender has minimal effect on emotional intelligence. Ansari (2015) studied to examine the relationship between undergraduate student's stress levels and their emotional development. This study showed that stress was significantly influenced by undergraduate student's emotional maturity, with stress increasing as emotional maturity decreased and decreasing as emotional maturity increased. Kundu, Saha and Mondal (2015) have studied, while there were significant disparities among especially competent individuals, there were no discernible variations in adjustment abilities between male and female undergraduate studying the humanities and sciences. Amalu (2017) conducted an investigation on academic performance in predicted by cognitive test anxiety among Makurdi's secondary students. Regression statistical analysis was used to examine the acquired data. The analysis of the gathered data indicated that cognitive test anxiety is a predictor of academic achievement. Bethel-Eke and Ikpa (2017) have studied how academic success and cognitive test anxiety are measured in River State secondary schools. The results of the study showed that, regardless of age, gender, and residential status at school, people commonly suffer from cognitive test anxiety as exam season approaches. Mondal and Saha (2017) investigated how the personalities and emotional intelligence of secondary school teachers affect their job satisfaction. According to the findings, teachers with high emotional intelligence report feeling more satisfied than those with medium or low emotional intelligence. Paul et al. (2017) investigated the connection between Purulia's secondary student's residence, gender, and creativity. According to the result boys are more creative than female students, and there is no clear difference in creativity between students in rural and urban regions. However, there is no discernible interaction between gender and dwelling location. Roy, Saha and Maji (2017) examined the opinions of B.Ed. students in Purulia district of West Bengal about inclusive education. The findings showed that the attitude of B.Ed. students was not significantly impacted by personal traits such as gender, residence, and stream.

Thomas et al. (2018) studied the severity of the cognitive test anxiety scale; the cut score was calculated using cluster analysis and latent class. The descriptive survey approach's findings demonstrated that determining CTAS-2 severity levels have practical implications for educators, students support staff, and students. Rasouli et al. (2018) conducted study on the impact of cognitive learning strategies on student's test anxiety and academic performance. The results showed how cognitive learning strategy training helped the girls in the guidance school do better academically and have less exam anxiety. Krispenz et al. (2019) explored the role of academic self-efficacy in reducing test anxiety and academic procrastination through the use of cognitive assessments. According to the study, it decreased exam anxiety and the ensuring academic procrastination. The effect on anxiety was influenced by an improvement in self-efficacy. Iorga et al. (2019) conducted a study on medical student's depression, anxiety, and stress. The study found that throughout medical student's academic training, stress, anxiety, and depression are significant problems. Arsha and Biswas (2020) examined to identify the behavioural, psychological, and sociodemographic factors that significantly affect Bangladeshi student's mental health as a consequence of the test. The findings demonstrated a high relationship between mental health characteristics and living with family, sleeping habits, eating habits, and time spent with parents. Khan et al. (2020) conducted research on how test anxiety is mediated by study techniques and positive psychological

traits in Nigerian students. The results of the route analysis showed a significant and direct correlation between exam anxiety and study skills (SSK). Maxwell and Ikechukwu (2020) investigated to evaluate the students in Rivers State's senior secondary schools exhibit cognitive test anxiety and examination misconduct. The study found a substantial correlation between exam misbehaviour, mental stress, low self-esteem, excessive shaking, and a sense of powerlessness among Rivers State Secondary school students. Ali, Ejaz, and Bagum (2021) investigated the impacts of student's cognitive test anxiety on secondary school exams by gender and school. According to this correlational study, students who have less cognitive test anxiety do better on SSC exam, and vice versa. Gayen and Sen (2021) examined the prevalence of depression, stress, anxiety among postgraduate students during the COVID-19 pandemic. According to the study's findings, there is a substantial correlation between anxiety, stress, and depression among female education department students throughout all semesters. Saha et al. (2021) have investigated clustering algorithms to analysis college student's attitude towards yoga. The results found that the majority of rural male and female students have similar views on yoga practices, indicating that the college's location is another crucial factor in creating clusters. Pate et al. (2021) assessed the impact of cognitive test anxiety on academic and standardised test performance. According to the findings, 18% of pharmacy students experience significant anxiety during exams, which can significantly impact their performance on a variety of traditional student success measures. Saha (2021) examined college student's perceptions of yoga practice in connection to their gender, residence, and stream of study. The results demonstrated that although opinions toward yoga practice differed by region and stream, gender did not substantially alter them. Sen et al. (2021) examined to ascertain the variations in stress, anxiety, and depression levels among postgraduate students during the COVID-19 pandemic. The results showed that postgraduate student's stress, anxiety, and depression levels were not significantly impacted by their gender, department, or semester.

Gorain et al. (2022) investigated on the correlation and cluster analysis of personality, social isolation, and internet dependency. Three unique clusters were identified by the results: one for science and one for each of the masculine and feminine arts. The correlations between internet dependency, social isolation, and personality factors, in students studying the arts and sciences were primarily low to mediocre. Nafuri et al. (2022) have studied on the use of clustering analysis to categorise the academic performance of students in higher education. This study used data from the worst 40% of students (B40) to create three unsupervised models: k-means, BIRCH, and DBSCAN. Out of all the models, the optimised k-means on Model B (KMoB) performed the best, according to the observational findings. Five B40 student's clusters were created by KMoB depending on their performance. With KMoB, this study might help the government raise graduation rates, lower HEI dropout rates, and ultimately improve the socioeconomics standing of students. Adhikari, Mahato and Sen (2023) examined among students studying social science and science, using depression and anxiety as independent variables. Postgraduate student's stress, general self-efficacy, and particular self-efficacy were assessed using DASS-21 and the self-efficacy scale. The findings of the study demonstrated a connection between each of the aforementioned traits. Adhikari & Sen (2023) carried out a study using cluster analysis to examine organisational atmosphere and institutional commitment. According to the study results found that teacher's perceptions of organisational climate and institutional commitment are comparable for both genders and rural and urban environments. Adhikari & Sen (2023a) carried out study on the latest developments in cluster analysis in education. The findings demonstrated how predictor counts contribute to the creation of educational clusters, how they relate to socio-psychological factors, and how predictor values rise as cluster counts do. Bakete and Akurugu (2023) investigated the difference in cognitive test anxiety and exam scores between college of education students by grade level and gender. According to the study, there was no statistically significant difference in the anxiety levels of level 100 and 200 students on cognitive tests ($p \geq .05$), despite the fact that female students reported high exam anxiety ($p=0.004$). Ansary et al. (2023) conducted a study on the clustering technique for analysing undergraduate student's attitudes towards value-oriented education. The study found that no relationship between undergraduate student's views toward value-oriented education and academic success, this study also discovered that location was the most important predictor. Mohanta et al. (2023) carried out a study on introspecting institutional commitment using cluster analysis. This study found that clusters emerged to investigate institutional climate, and the numbers of clusters positively impacted predictor influence, also the most influential dimension in cluster formation was professional commitment. Sen et al. (2023) have studied on clustering approach for analysing the head of the institution's leadership style and discovered that as the number of clusters rises, so do the number of predictors. The most important predictor is always location, while the importance of other predictors changes with the number of clusters. Based on the location of the organisation, comparable leadership style opinions are generally noted. Mahato, Sen and Adhikari (2023) examined the relationship between the independent components of general self-efficacy, stress, anxiety, and depression, as well as the dichotomous variables of male and female. The study's findings demonstrated that all of the previously mentioned characteristics are connected, at least for post-graduate students. Mahato, Gayen and Mahato (2023) investigated the relationship between Purulia, West Bengal, undergraduate student's internet addiction and academic resilience. The results revealed no connection between internet addiction and academic resilience. While there is a noticeable difference in internet education, and there is no evident difference in academic resilience between males and girls.

Das and Mahato (2024) explored on clustering techniques to analyse the positive mental health of students in West Bengal's Purulia district. It was successful in establishing correlations between positive mental health and its items, illustrating the complex inter-dimension relationships and the influence of specific factors on positive mental health clusters. Cluster Analysis on Smartphone Addiction of PG Students. Gayen (2024) investigated the cluster analysis of PG student's smartphone addiction. The results showed that the range of significant predictors increase in complexity as the number of clusters increase. In 10

clusters, location, smartphone addiction, and stream have emerged as strong cluster predictors, whereas gender, excessive usage, and relationships focused on cyberspace have emerged as minor cluster predictors. Mahato and Das (2024) examined the student's positive mental health in Purulia region of West Bengal. The results showed a high degree of mental health that was constant across residential origins, institutions, and genders. Ansary and Khatun (2025) investigated the relationship between undergraduate student's gender, location, and family structure and their smartphone addiction, stress, anxiety, and depression. The study concluded that there is no appreciable difference in stress, anxiety, and depression levels between male and female college students and those in rural and urban locations. Sen, et al. (2025) have investigated on the use of clustering analyse undergraduate student's attitudes toward the environment in the Purulia area of West Bengal. The study found that significant relationships among environmental behaviour, environmental emotion, environmental attitude, and environmental opinion. Das, B. (2025) has studied on clustering to explain internet addiction: a Purulia district study of undergraduate students. The major findings of the study were the variables influencing undergraduate student's internet addiction by highlighting the dynamic role of demographic determinants in clustering. Mondal (2025) conducted a study on postgraduate student's cognitive test anxiety (CTA) of Sidho-Kanho-Birsha university in Purulia, West Bengal. The study's main findings demonstrated that there was no discernible difference in CTA between postgraduate students in arts and those science, male and females, and those living in rural and urban locations.

The use of sophisticated statistical methods has propelled the notable advancements in educational research in the twenty-first century. These days, researchers use a variety of analytical techniques to improve the breadth and precision of their research, such as t-test, correlation analysis, Mahalanobis distance, and, Mann-Whitening U test.

In instance, the t-tests have been frequently used in many investigations. Among the noteworthy achievement in this field are Chatterjee et al. (2016); Karmakar et al. (2016); Mahanti, Mondal, and Saha (2016); Mondal et al. (2018); Gayen et al. (2021); Dandapat et al. (2021); Ansary, Saha, and Gorain (2021); Rajak and Gayen (2022); Ansary, Ansary, and Adhikari (2022); Khatun & Ansary, and Adhikari (2022); Khan et al. (2023); Das, Gayen, and Sen (2023); Adhikari et al. (2023); Mahato and Sen (2021, 2023); Mondal and Saha (2023); Ansary (2023); Ansary and Rakshit (2024) and Gayen and Sen (2023, 2023a).

Recent studies have also made extensive use of correlation analysis. Important research in this field includes those Kar and Saha (2021, 2021a); Sutradhar and Sen (2022, 2022a); Sutradhar et al. (2023); Mahato and Sen (2023); Gayen, Sen, and Adhikari (2023); Adhikari, Mahato, and Sen (2023); Mahato, Gayen, and Mahato (2023, 2023a, 2023b); Das, Gayen, and Sen (2023); Sen et al. (2023); Gayen (2024); Mahato, Das, and Gayen (2024); Das, Mahato, and Gayen (2024); and Das and Mahato (2024, 2024a).

Cluster analysis is a powerful metric similar to Mahalanobis's Distance measurement in the context of education those are, Adhikari (2023); Adhikari et al. (2023, 2023a); Mahato & Sen, (2021); Sen and Pal (2020); Sen et al. (2023a, 2023b, 2023c); and Ahamed et al. (2020, 2021,2022).

Finally, statistical research has made substantial use of the Mann-Whitney U test. Several well-known studies that use this approach are those by Saha and Adhikari (2021); Sen et al. (2021a, 2021b); Halder et al. (2022); and Mahato et al. (2022).

Using the research variables of residence, gender, and stream, the current study investigates different clusters in postgraduate student's cognitive test anxiety. To analyse cluster formation and the corresponding predictors with their degree of prediction (very high, high, mediocre, low and very low), varying numbers of clusters are taken into consideration. To find clusters, a two-step clustering approach is used.

## Objectives Of the Study

i) To identify the cluster using research variables-gender, stream, residence and CTA (Cognitive Test Anxiety).
ii) To assess predictor significance in cluster formation.

## Methodology

**Method:** A descriptive survey approach was used to conduct the study.
**Population:** The postgraduate students at Sidho-Kanho-Birsha University in Purulia, West Bengal, India makes up the research population.
**Sample:** To do this study, 363 postgraduate students from Sidho-Kanho-Birsha University's arts and science department were chosen as the study's sample.
**Sampling Technique:** For this investigation, the researcher used a stratified random sampling technique.
**Scale used:** The Cognitive Test Anxiety Scale (CTAS), by Cassady and Johnson (2002), was employed by the researcher. It has 17 items on a 4-point Likert type Scale.
**Statistical techniques Used:** The researcher has employed a Two-step clustering approach to classify the entire sample into distinct clusters.

## Result and Discussion

**Table 1: Formation of two clusters**

**Clusters**

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

| Cluster | 2 | 1 |
|---|---|---|
| Label | | |
| Description | | |
| Size | 57.0% (207) | 43.0% (156) |
| Inputs | Gender Female (100.0%) | Gender Female (50.0%) |
| | Residence Rural (100.0%) | Residence Urban (50.0%) |
| | Stream arts (100.0%) | Stream arts (59.6%) |
| | CTA 38.74 | CTA 35.53 |

There are two clusters. They are dominated by female students. One of them is fully comprised of rural students and for another cluster, half of the students are from urban areas. One female-dominated cluster is fully comprised of arts students and another cluster is dominated by more than half of female arts students.

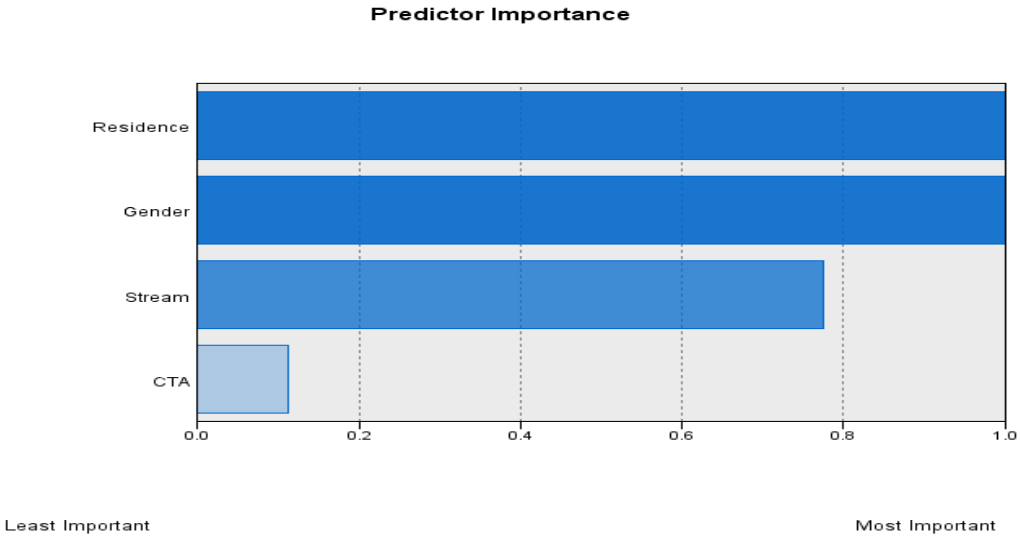


**Figure 1: Predictor importance for the clusters described in table 1**

From Figure 1, it is clear that residence and gender are very high predictors, where stream is a high predictor and CTA is a very low predictor of the clusters mentioned in Table 1.

**Table 2: Formation of three clusters**

**Clusters**

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

| Cluster | 3 | 1 | 2 |
|---|---|---|---|
| Label | | | |
| Description | | | |
| Size | 57.0% (207) | 21.5% (78) | 21.5% (78) |
| Inputs | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) |
| | Gender Female (100.0%) | Gender Female (74.4%) | Gender Male (74.4%) |
| | Stream arts (100.0%) | Stream arts (61.5%) | Stream arts (57.7%) |
| | CTA 38.74 | CTA 34.77 | CTA 36.28 |

There are three clusters. Two of them are formed mainly by female students and the third one is a male student-dominated cluster. For the female-dominated cluster, one of them is fully comprised by the arts stream and for another cluster, more than half of the students are from arts backgrounds. For the male-dominant cluster, more than half of the students are from the arts stream. For female students dominated clusters one of them fully comprised of rural background and another is fully comprised of urban areas. Another male-dominated cluster is fully made up of rural backgrounds.

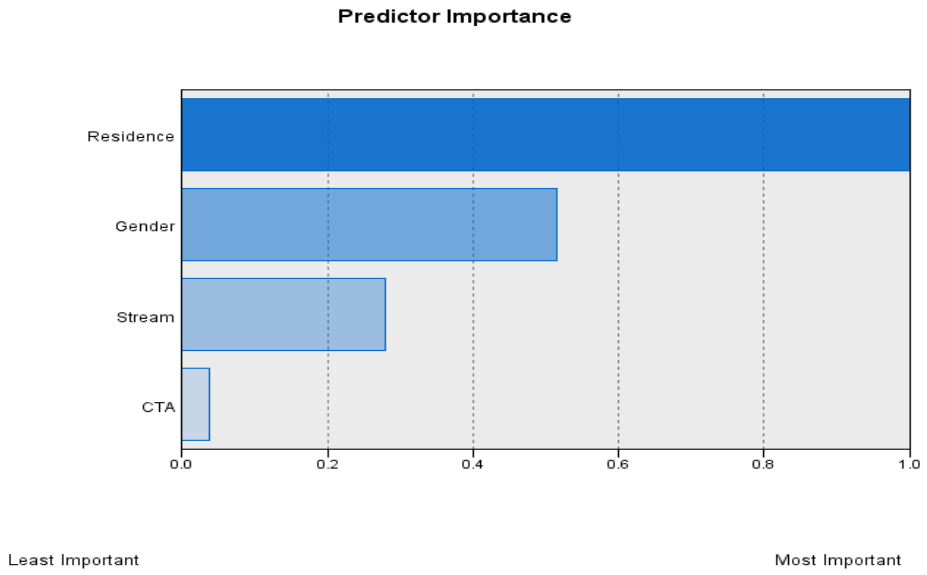


**Figure 2: Predictor importance for the clusters described in table 2**

From Figure 2, it is clear that residence is a very high predictor, gender is mediocre, stream is low, and CTA is a very low predictor of the clusters mentioned in Table 2.

**Table 3: Formation of five clusters**

**Clusters**

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

| Cluster | 5 | 1 | 4 | 3 | 2 |
|---|---|---|---|---|---|
| Label | | | | | |
| Description | | | | | |
| Size | 57.0% (207) | 16.0% (58) | 12.4% (45) | 9.1% (33) | 5.5% (20) |
| Inputs | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) |
| | Gender Female (100.0%) | Gender Female (100.0%) | Gender Male (100.0%) | Gender Female (60.6%) | Gender Male (100.0%) |
| | Stream arts (100.0%) | Stream arts (60.3%) | Stream arts (100.0%) | Stream Science (100.0%) | Stream arts (65.0%) |
| | CTA 38.74 | CTA 35.64 | CTA 36.91 | CTA 35.42 | CTA 32.25 |

There are five clusters. Three of them are formed mainly by female students, and two of them are male student-dominated. In female-dominated clusters, two clusters are fully comprised of arts and science students, and in one cluster more than half of students are from arts backgrounds. In male-dominated clusters, one of them is fully comprised of arts and another cluster is made up of more than half of the arts students. In female-dominated clusters, two clusters are fully comprised of rural areas students and another is fully comprised of urban backgrounds. In male-dominated clusters, one is fully comprised of rural and another is fully comprised of urban backgrounds students.

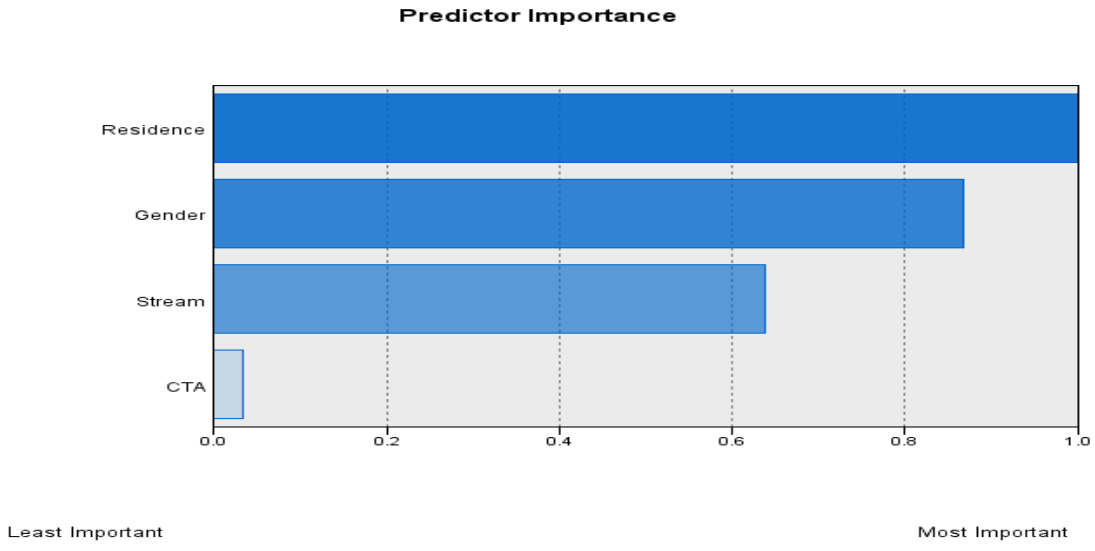


**Figure 3: Predictor importance for the clusters described in table 3**

From Figure 3, it is clear that residence and gender are very high predictors where stream is high, and CTA is a very low predictor of the clusters mentioned in Table 3.

**Table 4: Formation of seven clusters**

Clusters

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

| Cluster | 6 | 7 | 5 | 1 | 4 | 3 | 2 |
|---|---|---|---|---|---|---|---|
| Label | | | | | | | |
| Description | | | | | | | |
| Size | 39.9% (145) | 17.1% (62) | 12.4% (45) | 9.6% (35) | 9.1% (33) | 6.3% (23) | 5.5% (20) |
| Inputs | Residence Rural (100.0%) | Residence Rural (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Urban (100.0%) |
| | Stream arts (100.0%) | Stream arts (100.0%) | Stream arts (100.0%) | Stream arts (100.0%) | Stream Science (100.0%) | Stream Science (100.0%) | Stream arts (65.0%) |
| | Gender Female (100.0%) | Gender Female (100.0%) | Gender Male (100.0%) | Gender Female (100.0%) | Gender Female (60.6%) | Gender Female (100.0%) | Gender Male (100.0%) |
| | CTA 42.95 | CTA 28.90 | CTA 36.91 | CTA 37.06 | CTA 35.42 | CTA 33.48 | CTA 32.25 |

There are seven clusters. Five of them are formed mainly by female students and two of them are male students-dominated clusters. In female-dominated clusters, three clusters are fully comprised of art students and two clusters are fully comprised of science background students. In male-dominated clusters, one of them fully comprised of arts and another cluster made up of more than half of art students. In female-dominated clusters, three clusters are fully comprised of rural areas students and another two clusters are fully comprised of urban backgrounds. In male-dominated clusters, one is fully comprised of rural and another is fully comprised of urban backgrounds students.

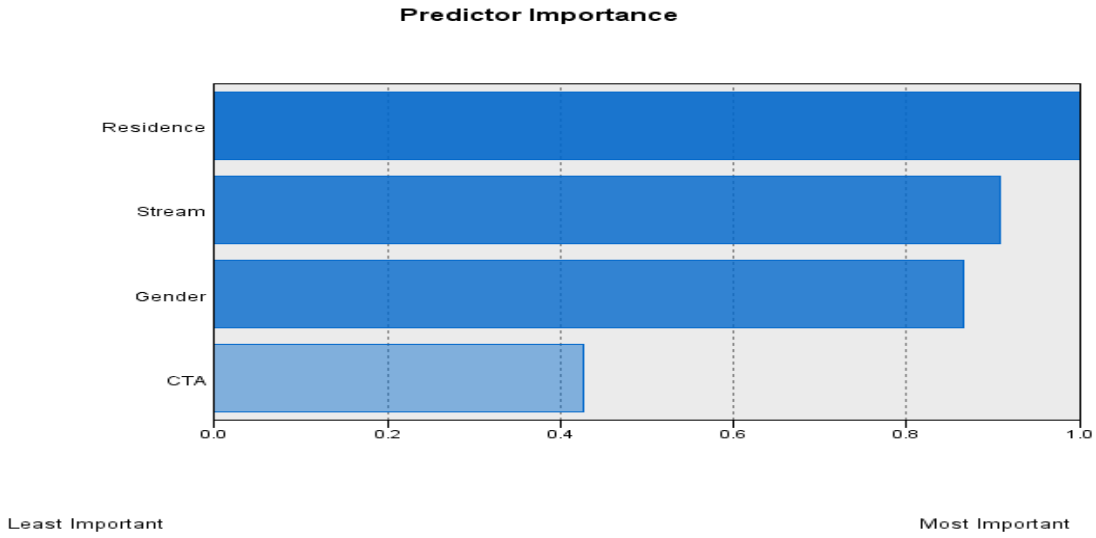


**Figure 4: Predictor importance for the clusters described in table 4**

From Figure 4, it is clear that residence, stream and gender are very high predictors, and CTA is a mediocre predictor of the clusters mentioned in Table 4.

**Table 5: Formation of ten clusters**

Clusters

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

| Cluster | 7 | 9 | 6 | 1 | 8 | 4 | 10 | 2 | 5 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| Label | | | | | | | | | | |
| Description | | | | | | | | | | |
| Size | 33.6% (122) | 15.7% (57) | 12.4% (45) | 9.6% (35) | 7.7% (28) | 6.3% (23) | 5.5% (20) | 3.6% (13) | 3.6% (13) | 1.9% (7) |
| Inputs | Gender Female (100.0%) | Gender Female (100.0%) | Gender Male (100.0%) | Gender Female (100.0%) | Gender Female (100.0%) | Gender Female (100.0%) | Gender Female (100.0%) | Gender Male (100.0%) | Gender Male (100.0%) | Gender Male (100.0%) |
| | Residence Rural (100.0%) | Residence Rural (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) | Residence Rural (100.0%) | Residence Urban (100.0%) |
| | Stream arts (100.0%) | Stream arts (100.0%) | Stream arts (100.0%) | Stream arts (100.0%) | Stream arts (100.0%) | Stream Science (100.0%) | Stream Science (100.0%) | Stream arts (100.0%) | Stream Science (100.0%) | Stream Science (100.0%) |
| | CTA 39.98 | CTA 28.46 | CTA 36.91 | CTA 37.06 | CTA 54.32 | CTA 33.48 | CTA 36.05 | CTA 31.38 | CTA 34.46 | CTA 33.86 |

There are ten clusters. Six of them are formed mainly by female students, and four of them are male-students-dominated clusters. In female-dominated clusters, four clusters are fully comprised of art students and another two clusters are fully comprised of students with science backgrounds. In male-dominated clusters, two of them are fully comprised of art students, and another two clusters are fully made up of science background students. In female-dominated clusters, four clusters are fully comprised of rural areas students, and another two clusters are fully made up of urban backgrounds. In male-dominated clusters, two of them are fully comprised of rural students, and another two clusters are fully made up of urban backgrounds students.

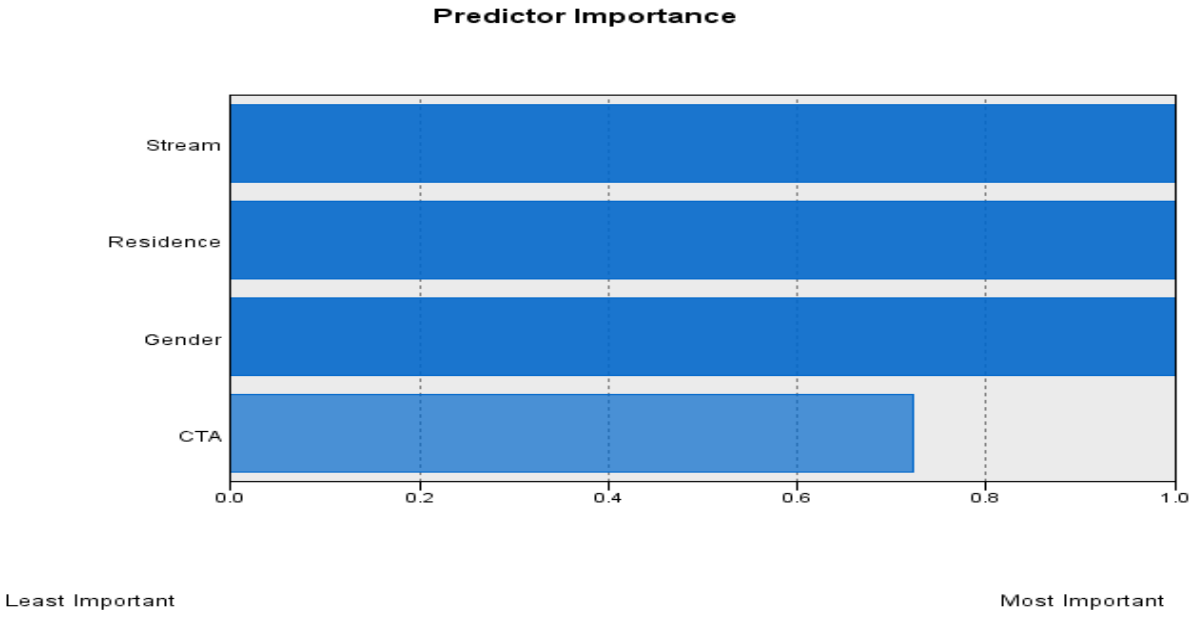


**Figure 5: Predictor importance for the clusters described in table 5**

From Figure 5, it is clear that stream, residence, and gender are very high predictors, where CTA is a high predictor of the clusters mentioned in Table 5.

**Table 6: Cluster and Predictor Summary**

| Number of Clusters | Very High Predictors | High Predictors | Mediocre Predictors | Low Predictors | Very Low Predictors |
|---|---|---|---|---|---|
| 2 | Residence Gender | Stream | | | CTA |
| 3 | Residence | | Gender | Stream | CTA |
| 5 | Residence Gender | Stream | | | CTA |
| 7 | Residence Stream Gender | | CTA | | |
| 10 | Stream Residence Gender | CTA | | | |

Table 6, displayed the clusters and their predictors, revealing variations in cluster size and predictors, when examining clusters with number 2, 5, 7 and 10. In formation of 2 clusters, residence and gender are very high predictors, stream is a high predictor and CTA is a very low predictor. Residence is a very high predictor, gender is a mediocre predictor, stream is a low predictor and CTA is a very low predictor when 3 clusters are considered. In case of 5 clusters, residence and gender are very high predictors, stream is a high predictor and CTA is also a very low predictor. Residence, stream and gender shown very high predictors, and CTA is a mediocre predictor when 7 clusters are considered. Stream, residence and gender shown very high predictors and CTA is a high predictor when 10 clusters are considered. So, to remark on objective 1, which states "to identify the cluster using research variables-gender, stream, residence and CTA (Cognitive Test Anxiety)", it is clear that to make clusters, all research variables, are fully responsible. Next, let us consider objective 2, which states "to assess predictor significance in cluster formation", it was found when 2 clusters are formed, residence, gender and stream played a more major role, and CTA played a minor role. But when clusters formed in 3 then shown the variation of predictors. In formation of 5 cluster, residence, gender and stream played a more major role and CTA played a minor role. In 7, and 10 clusters; stream, gender and residence played a more major role as predictors and CTA played a major predictor.

## Conclusion

It is evident from the said research that, when various socio-psychological factors are taken into account, the number of predictors significantly influenced cluster formation in education (Adhikari & Sen, 2023b). In summary, this study successfully achieved its objectives. Variables such as residence, gender and stream were identified as contributors to distinct clusters and their influence on CTA. As the number of clusters increases, the significance of the predictors likewise shifts, with location, gender and stream turn to be the major predictors (Adhikari & Sen, 2023c). The study's conclusions showed that as the clusters grow, from 2 to 10 clusters the residence, gender, stream and CTA as predictors become significant. Therefore, from the above discussion, it can be said that the residence and gender are very high, the stream is mediocre and CTA is low for small clusters but becomes high for large number of clusters.

**Acknowledgment:** No
**Author's Contribution:** *Shankar Mondal*: Literature Review, Methodology, Analysis, Referencing and *Surajit Mahato:* Data Collection, Analysis, Referencing
**Funding:** No
**Declaration:** All the authors have given consent for the publication.
**Competing Interest:** No

**References:**

1. Adhikari, A. (2023). Application of Mahalanobis Distance in Education and Educational Psychology: A Mini Review. *Innovare Journal of Education, 11*(4), 5-7. 10.22159/ijoe.2023v11i4.47671
2. Adhikari, A., & Sen, S. (2023). Cluster Analysis on Institutional Commitment and Organizational Climate. *International Journal of Research Publication and Reviews, 4*(5), 4974-4988.
3. Adhikari, A., & Sen, S. (2023a). Recent Trends of Cluster Analysis in Education. *International Research Journal of Modernization in Engineering Technology and Science, 5*(8), 1858-1861.
4. Adhikari, A., Mahato, R. C., & Sen, S. (2023). Anxiety, Depression, Stress, General Self-efficacy and Specific Self-efficacy: Comparison Among Science and Social Science Students. *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), 3*(1), 382-389.

5. 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.
6. 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.
7. Akinsola, E. F., & Nwajei, A. D. (2013). Test Anxiety, Depression and Academic Performance: Assessment and Management Using Relaxation and Cognitive Restricting Techniques. *Psychology, 6*(4), 18-24.
8. Ali, H., Ejaz, A., & Bagum, M. (2021). Student's Cognitive Test Anxiety and Secondary School Examination Performance: Moderating Effect of Gender and School Sector. *Review of Education, Administration and Law (REAL), 4*(3), 729-738.
9. Amalu, M. N. (2017). Cognitive Test Anxiety as a Predictor of Academic Achievement Among Secondary School Students in Makurdi, Metropolis, Benue State. *International Journal of Scientific Research in Education, 10*(4), 362-372.
10. Ansari, M. (2015). Role of Emotional Maturity on Stress Among Undergraduate Students. *International Journal of Indian Psychology, 2*(2), 19-25.
11. 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.
12. Ansary, K., Gorain, S. C., & Saha, B. (2023). Attitude Towards Vulue-oriented Education Among Undergraduate Students. *International Journal of Advanced Education and Research, 8*(1), 17-19.
13. Ansary, K., 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.
14. Ansary, K., & Khatun, K. S. (2025). A Study on Smartphone Addiction, Anxiety, Stress and Depression of Undergraduate Students. *The Social Science Review A Multidisciplinary Journal, 3*(1), 56-61. https://doi.org/10.70096/tssr.250301010
15. Ansary, K., Saha, B., & Gorain, S. C. (2021). A Study on Achievement Motivation of Undergraduate Students. *International Journal of Multidisciplinary Educational Research, 10[9*(7)], 118-121.
16. Ansary, K., & Saha, B. (2023). Construction and Standardization of Adjustment Ability Inventory. *International Journal of Creative Research Thoughts (IJCRT), 11*(3), h559-h567.
17. Ansary, K., & Rakshit, S. (2024). Internet Usage on Academic Achievement among the Undergraduate Students. *The Social Science Review A Multidisciplinary Journal, 2*(4), 114-120.
18. Ansary, K. (2023). Study on School Adjustment and Academic Achievement of the Higher Secondary School Students. *The Social Science Review A Multidisciplinary Journal, 1*(2), 113-121.
19. Arusha, A. R., & Biswas, R. K. (2020). Prevalence of Stress, Anxiety and Depression Due to Examination in Bangladeshi Youth: A Pilot Study. *Children and Youth Services Review, 116*, 1-6.
20. Bakete, R. A., & Akurugu, D. A. (2023). Hypothesizing Cognitive Test Anxiety and Academic Performance by Gender and Level of College of Education Students in Ghana. *Journal of Advanced Research and Multidisciplinary Studies, 3*(3), 45-55.
21. Bethel-Eke, O. E., & Ikechukwu, I. A. (2017). Evaluation of Cognitive Test Anxiety and Academic Performance of Students in Public Secondary Schools in Rivers State. *International Journal of Innovative Education Research, 5*(4), 7-15.
22. Cassady, J. C., & Johnson, R. E. (2002). Cognitive Test Anxiety and Academic Performance. *Contemporary Educational Psychology, 27*(2), 270-295.
23. Chatterjee, R., Mondal, B. C., & Saha, B. (2016). Student Attitudes Towards Using Social Media for Educational Purpose. *European Academic Research, 4*(6), 5365-5376.
24. Das, B. (2025). Understanding Internet Addiction Through Clustering: A Study of Undergraduate Students in Purulia District. *The Social Science Review A Multidisciplinary Journal, 3*(2), 247-257. https://doi.org/10.70096/tssr.250302034
25. Das, B., & Gayen, P., & Sen, S. (2023b). Lifestyle of Health and Sustainability (LOHAS) of Undergraduate Students of Purulia District of West Bengal. *EPRA International Journal of Socio-Economic and Environmental Outlook (SEEO), 10*(8), 13-19.
26. Das, B., & Mahato, S. (2024). Analysing Positive Mental Health Among Students in Purulia District, West Bengal, Using Clustering Techniques. *The Social Science Review A Multidisciplinary Journal, 2*(3), 12-26.
27. Das, B., Mahato, S., & Gayen, P. (2024). Lifestyle of Health and Sustainability (LOHAS): Differentiating Relationship in Regards to Stream of Study. *The Social Science Review A Multidisciplinary Journal, 2*(1), 1-13.
28. Dandapat, M., Paramanik, S. C., Gayen, P., & Gorain, S. C. (2021). Attitude of Secondary School Teachers Towards Using ICT in English Classroom of Purulia District. *International Journal of Research and Analytical Reviews (IJRAR), 8*(1), 583-590.
29. Dol, S. M., & Jawandhiya, P. M. (2023). Classification Technique and its Combination with Clustering and Association Rule Mining in Education Data Mining- A Survey. *Engineering Applications Artificial Intelligence, 122*, 106071.
30. Facca, T. M., & Allen, S. J. (2011). Using Cluster Analysis to Segment Students Based on Self-Reported Emotionally Intelligent Leadership Behaviours. *Journal of Leadership Education, 10*(2), 72-96.
31. Furlan, L., Cassady, J. C., & Pere, E. R. (2009). Adapting the Cognitive Test Anxiety Scale for Use with Argentinean University Students. *International Journal of Testing, 9*(1), 3-19.
32. 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.
33. Gayen, P., & Sen, S. (2023). A Study on Interest in Teaching of Pre-service Language Trainee Teachers of Bankura and Purulia District of West Bengal. *International Journal of Multidisciplinary Educational Research, 12*[7(1)], 79-83.
34. Gayen, P., Dandapat, M., Das, C., & Ansary, K. (2021). Attitude Towards English as a Language and Medium of Instruction: A Study in Secondary School Students in Cooch Behar District of West Bengal. *International Journal of Research and Analytical Reviews (IJRAR), 8*(1), 120-124.
35. Gayen, P. (2024). Cluster Analysis on Smartphone Addiction of PG Students. *The Social Science Review A Multidisciplinary Journal, 2*(5), 118-128. https://doi.org/10.70096/tssr.240205020
36. 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.
37. 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 (IJRD), 6*(9), 179-184.

38. 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.
39. Gulcicegi, D., & Alisah, A., (2024). Cognitive Test Anxiety and Academic Performance of Undergraduate Students in Istanbul. *International Journal of Linguistics, Literature and Translation, 7*(4), 118-123.
40. Haldar, 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.
41. Iorga, M., Muraru, I. D., Munteanu, C., & Petrariu, F. D. (2019). Depression, Anxiety and Stress Among Medical Students. *The Medical-Surgical Journal, 123*(3), 496-505.
42. Kar, D., Saha, B., & Mondal, B. C. (2014). Attitude of University Students Towards E-learning in West Bengal. *American Journal of Educational Research, 2*(8), 669-673. DOI:10.12691/education-2-8-16
43. Kar, D., Saha, B., & Mondal, B. C. (2014a). Measuring Emotional Intelligence of Secondary School Students in Relation to Gender and Residence: An Empirical study. *American Journal of educational research, 2*(4), 193-196. DOI: 10.12691/education-2-4-3
44. 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.
45. Kar, D., & Saha, B. (2021). Leadership Style and Adjustment Ability Among Undergraduate Students: A Correlational Study. *International Journal of Creative Research Thoughts (IJCRT), 9*(9), d148-d151.
46. 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.
47. Khan, A., Grema, M. A., Latif, A. B. A., Bahar, H., Iswan, I. S. S., Baranovich, D. L., Kosnin, A. B. M., Rosman, A. S., Mokhtar, M., Hassan, Z., Ismail, S., & Panatik, S. A. (2020). Mediating Effect of Positive Psychological Strength and Study Skills on Examination Anxiety Among Nigerian College Students. *Sustainability, 12*(4), 2-16.
48. 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 Sciences, 4*(1), 1-10.
49. Khatun, S., Ansary, K., & Adhikari, A. (2022). Attitude Towards Yoga Education Among Undergraduate Students. *EPRA International Journal of Multidisciplinary Research (IJMR), 8*(12), 9-13.
50. Krispenz, A., Gort, C., Schultke, L., & Dickhauser, O. (2019). How to Reduce Test Anxiety and Academic Procrastination Through Inquiry of Cognitive Appraisals: A Pilot Study Investigating the Role of Academic Self-Efficacy. *Frontiers in Psychology, 10*, 1-14.
51. Kultur, Y. Z., & Ozcan, B., (2022). The Impact of Cognitive and Affective Components of Test Anxiety on the High-Stakes Exam Performance in 12th Grade Students. *International Journal of Progressive Education, 18*(1), 448-457.
52. 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.
53. Lufi, D., & Darliuk, L. (2005). The Interactive Effect of Test Anxiety and Learning Disabilities Among Adolescents. *International Journal of Educational Research, 43*(4(5), 236–249.
54. 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.
55. Mahato, A., Gayen, P., & Mahato, R. C. (2023). 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.
56. Mahato, D., Gayen, P., & Mahato, R. C. (2023a). Relationship Between Academic Resilience and Internet Addiction of Undergraduate Students of India District of West Bengal: A Study. *EPRA International Journal of Multidisciplinary Research (IJMR), 9*(3), 103-106.
57. Mahato, M., Gayen, P., & Mahato, R. C. (2023). 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.
58. Mahato, S., & Das, B. (2024). Mental Well-Being Among Students with Respects to Gender, Institution and Residence: Insights from Purulia District, West Bengal. *The Social Science Review A Multidisciplinary Journal, 2*(2), 164-175.
59. Mahato, R. C., Sen, S., & Adhikari, A. (2023). A Study of DASS-21 and the Self-Efficacy Scale on Post-Graduate Students. *International Journal of Research Publication and Reviews, 4*(6), 4249-4255.
60. 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 (IJAEM), 3*(5), 1398-1401.
61. Mahato, R. C., & Sen, S. (2021a). 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 (IJCRT), 9*(5), c969-c980.
62. Mahato, S., Das, B., & Gayen, P. (2024). Achievement on Language Subjects of Secondary School Students: Differentiating Relationships in Regard to Gender and Type of Institute. *The Social Science Review A Multidisciplinary Journal, 2*(1), 78-86.
63. Mahato, R. C., & Sen, S. (2023). A Study of Contexts Knowledge (CK1), Technological Pedagogical Content Knowledge (TPCK) and Attitudes Towards Creative Teaching (ACT) Among the Pre- Service Mathematics Trainee Teachers in West Bengal, India. *Journal of Emerging Technologies and Innovative Research (JETIR), 10*(4), h35-h43.
64. Mahato, D., Gayen, P., & Mahato. R. C. (2023). Relationship Between Academic Resilience and Internet Addiction of Undergraduate Students of Purulia District of West Bengal- A Study. *EPRA International Journal of Multidisciplinary Research, 9*(3), 103-106.
65. Maxwell, E., & Ikechukwu, I. A. (2020). Cognitive Test Anxiety and Examination Malpractices Among Senior Secondary School Students in Rivers State. *International Journal of Scholarly and Educational Research in Africa. 12*(6). 48-59.
66. 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.
67. Mohanta, R., Sen, S., Adhikari, A., & Pal, I. (2023a). Perceptional Environment: A Study on Organizational Climate Using Cluster Analysis. *International Journal of Research Publication and reviews, 4*(4), 1336-1346.
68. 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.

69. 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.
70. Mondal, A., Ansary, K., Gprain, 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.
71. Mondal, S. (2025). The Study on Postgraduate Student's Cognitive Test Anxiety (CTA) at Sidho-Kanho-Birsha University in Purulia, West Bengal. *The Social Science Review A Multidisciplinary Journal, 3*(2), 57-64. https://doi.org/10.70096/tssr.250302010
72. Mondal, N., & Saha, B. (2013). Achievement Difference in Science at Secondary Level in Darjeeling District: A Comparative Study. *International Journal of Scientific Research, 2*(2), 85-86. DOI: 10.15373/22778179/FEB2013/31
73. Nafuri, A. F. M., Sani, N. S., Zainudin, N. F. A., Rahman, A. H. A., & Aliff, M. (2022). Clustering Analysis for Classifying Student Academic Performance in Higher Education. *Applied Sciences, 12*(19), 1-22. https://doi.org/10.3390/app12199467
74. Oyewole, G. L., & Thopil, G. A. (2023). Data Clustering: Application and Trends. *Artificial Intelligence Review, 56,* 6439-6475. https://doi.org/10.1007/s10462-022-10325-y
75. Paul, A., Karmakar, T., Mondal, A., & Saha, B. (2017). Creativity among Secondary Students in relation to Gender and Residence. *International Journal of Informative & Futuristic Research, 4*(5), 6194-6199.
76. Pate, A. N., Neely, S., Malcom, D. R., Daugherty, K. K., Zagar, M., & Medina, M. S. (2021). Multisite Study Assessing the Effect of Cognitive Test Anxiety on Academic and Standardized Test Performance. *American Journal of Pharmaceutical Education, 85*(1), 43-54.
77. Putwain, D.W., Connors, L., & Symes, W. (2010). Do Cognitive Distortions Mediate the Test Anxiety – Examination Performance Relationship? *Educational Psychology, 30*(1), 11-26.
78. Paramanik, J., Saha, B, & Mondal, B. C. (2014). Adjustment of Secondary School Students with Respect to Gender and Residence. *American Journal of Educational Research, 2*(12), 1138-1143.
79. Rasouli, R., Alipour, Z., & Ebrahim, T. (2018). Effectiveness of Cognitive Learning Strategies on Test Anxiety and School Performance of Students. *International Journal of Educational and Psychological Researches, 4*(1), 20-25.
80. Rana, R. A. & Mahmood, N. (2013). The Relationship Between Test Anxiety and Academic Achievement. *Bulletin of Education and Research, 32*(2), 63–74.
81. 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.
82. Rajak, P., & Gayen, P. (2022). A Study of The Interests in Mathematics of Secondary Level Students of West Bengal. *International Journal of Research Publication and Reviews, 3*(6), 132-135.
83. 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.
84. 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.
85. Saha, B., & Adhikari, A. (2021). Measuring Social Relationship of Undergraduate College Students of West Bengal. *Education India Journal: A Quarterly Referred Journal of Dialogues on Education, 10*(4), 261-269.
86. 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.
87. 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.
88. Saha, B. (2012). A Comparative Study of Environmental Awareness among Teacher Trainees of West Bengal. *Indian Streams Research Journal, 2*(9), 1-5.
89. Saha, B. (2012a). Creativity in Relation to Socio-Economic Status in Secondary School Students in West Bengal. *Indian Journal of Applied Research, 2*(2), 60-61.
90. 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. DOI: 10.15373/22778179/AUG2013/34
91. Saha, B., Maji, S., & Saha, C. (2012). A Comparative Study of Gender in Regard to SES, Environmental Awareness and Creativity in Birbhum District. *Golden Research Thoughts 2*(6), 1-3.
92. 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.
93. 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.
94. Sen, S., & Samanta, T. K. (2013). A Study on The Effect of Unit Tests in Secondary Level Schools of Birbhum District, West Bengal. *Sikshachintan, 7*, 21-24.
95. Sen, S., Mahato, S., Mahato, R. C., & Das, B. (2025). Clustering Technique for Analysing Environmental Attitude Among Undergraduate Students in Purulia District, West Bengal. *Journal of Social Studies, 21*(1), 1-12.
96. Sen, S., Saha, B., & Adhikari, A. (2025). A Multivariate Analysis Using Mahalanobis Distance on the Big Five Inventory and DASS-21. *American Journal of Educational Research, 13*(3), 139-147.
97. Sen, B., Mondal, N., & Saha, B. (2013). A Comparative Study of Poor Achievement in Physics at the Higher Secondary level with Respect to Secondary level in Birbhum District. *International Journal of Scientific Research, 2*(4), 66-67. DOI: 10.15373/22778179/APR2013/26
98. 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.
99. 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.
100. 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.
101. Sutradhar, A., Adhikari, A., Sutradhar, S. M., & Sen, S. (2023). Use of Correlational Analysis in Educational Research. *International Research Journal of Education and Technology, 5*(5), 731-737.

102. Thomas, C. L., Cassady, J. C., & Finch, W. H. (2018). Identifying Severity Standards on the Cognitive Test Anxiety Scale: Cut Score Determination Using Latent Class and Cluster Analysis. *Journal of Psychoeducational Assessment, 36*(5), 492-508.
103. Yang, S. (2012). Exploring College Students' Attitudes and Self-efficacy of Mobile Learning. *TOJET: The Turkish Online Journal of Educational Technology, 11*(4), 148-154.