PCA-SVM REGRESSION ANALYSIS FOR ACADEMICIAN SATISFACTION IN PUBLIC HIGHER EDUCATION INSTITUTIONS: THE MEDIATING EFFECT OF GLOBAL MINDEDNESS

Gan Wei[1*], Shankar Chelliah[2]
[1*]Universiti Sains Malaysia
Level 1, Building E42, Chancellory II,
Universiti Sains Malaysia, 11800 USM Penang, Malaysia
[2]Universiti Sains Malaysia
Level 1, Building E42, Chancellory II,

Abstract: Higher education institutions play a crucial role in shaping academic experience and cultivating a global mindset among academics in today's globalized world. In the context of public higher education institutions, the purpose of this study is to investigate the connection between academic satisfaction and global mindedness. It also looks into the possibility of global mindedness acting as a mediator between academician satisfaction and a variety of outcome variables.

To collect data from academic staff members at public higher education institutions, the study employs a mixed-methods approach that includes quantitative surveys and qualitative interviews. The quantitative examination includes factual methods like connection investigation, relapse investigation, and intercession examination to analyze the connections between the factors of revenue. The interviews' qualitative data are analyzed thematically to learn more about academics' experiences and perspectives.

The findings reveal a positive relationship between academician satisfaction and global mindedness, indicating that academicians who are more satisfied with their work tend to exhibit higher levels of global mindedness. Furthermore, the mediating effect of global mindedness is observed, suggesting that global mindedness partially mediates the relationship between academician satisfaction and various outcome variables, such as job performance, professional development, and organizational commitment.

These findings have significant implications for public higher education institutions aiming to enhance academician satisfaction and promote a global mindset among their faculty members. By understanding the mediating role of global mindedness, institutions can implement targeted strategies and initiatives to improve job satisfaction, foster a global perspective, and ultimately enhance overall academic performance and commitment.

Overall, this study contributes to the existing literature by shedding light on the complex relationship between academician satisfaction, global mindedness, and various outcome variables. It provides valuable insights for policymakers, administrators, and academic staff members in public higher education institutions to create supportive and globally-oriented environments that foster academician satisfaction and professional growth.

Keywords: academician satisfaction, public higher education institutions, teaching resources, research facilities, administrative support, institutional policies, student engagement, work-life balance, career advancement opportunities, compensation and benefits, global mindedness, intercultural communication, collaborative research opportunities, cross-cultural collaboration

1. INTRODUCTION

In todays rapidly evolving global landscape, higher education institutions play a pivotal role in shaping the academic experience and preparing academicians to navigate the challenges and opportunities of a globalized world [1,2]. Public higher education institutions, in particular, have a critical responsibility to foster an environment that nurtures the satisfaction and professional growth of their academic staff members [3, 4]. Academician satisfaction as shown in figure 1 is not only essential for the well-being and motivation of faculty members but also has a direct impact on their job performance, professional development, and organizational commitment [5].
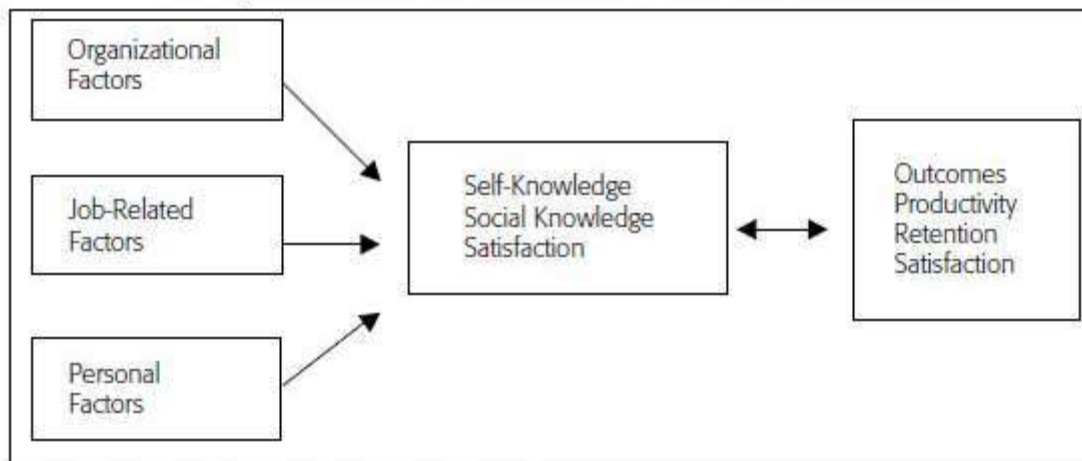

Figure 1: Academic staff job satisfaction

As the world becomes increasingly interconnected, it has become imperative for academic staff to possess a global mindset - openness to diverse perspectives, an awareness of global issues, and the ability to collaborate across cultural boundaries [6, 7]. A global mindset equips academicians to engage in international research collaborations, attract students from diverse backgrounds, and contribute to the global knowledge pool [8, 9]. Hence, exploring the relationship between academician satisfaction and global mindedness can provide valuable insights into fostering a more enriched academic environment [10].

This research aims to investigate the association between academician satisfaction and global mindedness in the context of public higher education institutions. By delving into this relationship, the study seeks to identify the potential mechanisms through which global mindedness may influence academician satisfaction and vice versa [11, 12]. Moreover, it expects to investigate the intervening impact of worldwide mindedness on the connection between academician fulfillment and key result factors, like work execution, proficient turn of events, and authoritative responsibility as displayed in figure 2[13, 14].
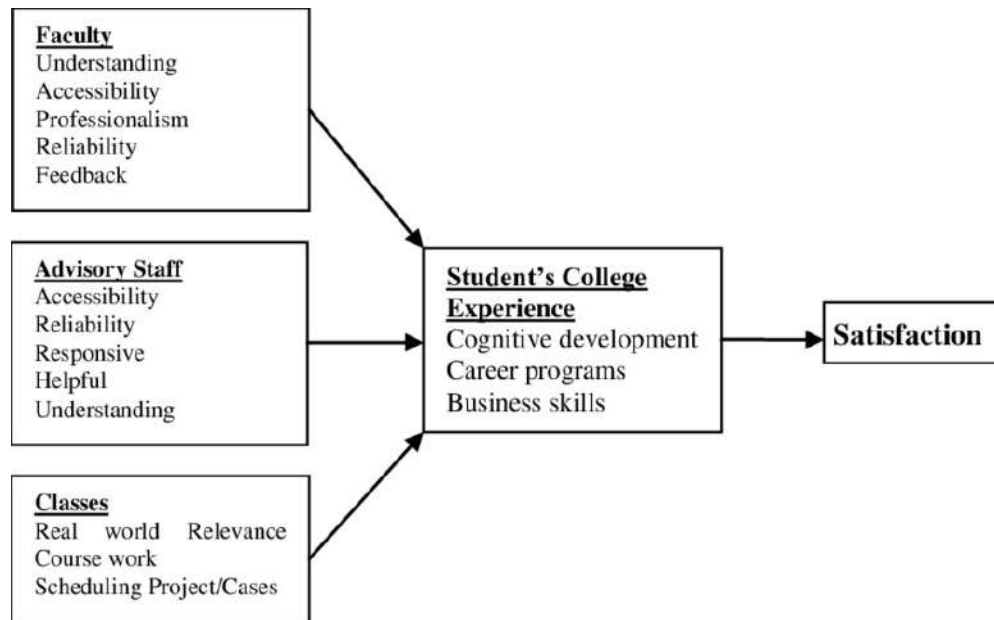
Figure 2: Conceptual satisfaction factors

To achieve a comprehensive understanding, the research adopts a mixed-methods approach. Quantitative surveys will be administered to academic staff members to collect data on their levels of job satisfaction and global mindedness [15]. Connection and relapse investigations will be performed to evaluate the nature and strength of the connection between these factors. Furthermore, intercession examination will be led to look at the job of worldwide mindedness as an intervening component in the connection between academician fulfillment and different result factors [16].

Qualitative interviews with select participants will be conducted to gather in-depth insights into the experiences and perspectives of academicians. The qualitative data analysis will be carried out thematically, providing a nuanced understanding of the factors influencing academician satisfaction and the development of a global mindset [17].

The study's outcomes are expected to shed light on the complex interplay between academician satisfaction and global mindedness, offering valuable implications for policymakers, administrators, and academic staff in public higher education institutions. By uncovering the mediating effect of global mindedness, institutions can design targeted interventions and strategies to enhance job satisfaction, encourage global perspective among faculty, and foster an inclusive and supportive academic community [18].

In conclusion, this research seeks to contribute to the existing literature by exploring the dynamic relationship between academician satisfaction and global mindedness in public higher education institutions. The findings hold the potential to drive positive changes in the way institutions nurture their academic staff and create an intellectually stimulating environment that thrives on a global platform. Ultimately, this study aligns with the broader goal of advancing education for a globalized world and promoting excellence in academic practice [19].

2. EXISITNG ANALYSIS RESEARCH TECHNIQUES

The analysis techniques used in existing research on the topic may vary depending on the specific studies conducted. However, some commonly employed analysis techniques in this field of research include [21,21]:

1. Descriptive Statistics: Illustrative insights are utilized to sum up and depict the critical attributes of the gathered information. Mean, median, standard deviation, and frequency distributions are examples of this.

2. Connection Investigation: Connection investigation is utilized to look at the connection between factors. It decides the strength and heading of the relationship between academician fulfillment, worldwide mindedness, and other pertinent variables.

3. Relapse Investigation: The relationship between the dependent variable (academician satisfaction) and the independent variables (such as global mindedness and other factors) is frequently investigated using regression analysis. It aids in determining the degree to which global consciousness serves as a mediator in the relationship [22].

4. Analysis of Mediation: The specific purpose of mediation analysis is to investigate how global mindedness mediates the relationship between academician satisfaction and other variables. It aids in determining whether global mindedness contributes significantly to the relationship's explanation.

5. Primary Condition Demonstrating (SEM): SEM is a statistical method for evaluating and confirming intricate relationships among numerous variables. It takes into account the assessment of immediate and roundabout impacts and can be used to survey the interceding impact of worldwide mindedness on academician fulfillment.

6. Subjective Investigation: To get a deeper understanding of, qualitative methods like content analysis, focus groups, and interviews can be used in addition to quantitative analysis. the experiences and perceptions of academicians regarding their satisfaction and global mindedness.

These analysis techniques provide researchers with a comprehensive understanding of the factors influencing academician satisfaction and the mediating role of global mindedness in the context of public higher education institutions. It is important to note that the specific techniques used may vary across studies based on research design, data collection methods, and research objectives.

2.1. Challenges

It can be difficult to analyse academician satisfaction in publicly owned colleges and universities when global mindedness acts as a mediating factor. Some of the common challenges encountered in this type of analysis include:

1. Data Collection: Collecting accurate and reliable data from a diverse group of academicians can be challenging. It may involve survey administration, interviews, or other data collection methods. Ensuring high response rates and minimizing non-response bias can be a challenge.

2. Construct Measurement: Operationalizing and measuring constructs such as academician satisfaction and global mindedness accurately can be challenging. Developing reliable and valid measurement scales that capture the multidimensional nature of these constructs requires careful consideration and piloting.

3. Sample Size and Representativeness: Obtaining a representative sample of academicians from public higher education institutions can be challenging due to practical limitations, such as limited access to the target population. Inadequate sample size can affect the generalizability of the findings and statistical power of the analysis.

4. Multicollinearity: Multicollinearity occurs when independent variables in regression models are highly correlated with each other. This can pose challenges in interpreting the individual effects of predictors and may lead to unstable parameter estimates.

5. Endogeneity: Endogeneity refers to the issue of reciprocal causality or the presence of reverse causality in the relationships being studied. In the context of academician satisfaction and global mindedness, endogeneity can occur if changes in academician satisfaction also affect global mindedness, creating a feedback loop. Addressing endogeneity requires advanced statistical techniques such as instrumental variable analysis or longitudinal designs.

6. Interpretation of Mediation Effects: Interpreting mediation effects can be complex, and establishing causal relationships can be challenging. Proper causal inference techniques, such as longitudinal designs or experimental studies, may be required to strengthen the evidence for the mediating effect of global mindedness.

7. Generalizability: The findings of the analysis may be specific to it may not be generalizable to other locations or people outside of the context of public higher education institutions. It is crucial to recognise the study's limitations and interpret the results with care.

In order to meet these hurdles, careful study design, rigorous data collection techniques, proper statistical analysis, and a critical appreciation of the constraints and underlying premises of the selected methodologies are required. Additionally, context-specific elements that may affect the analysis and interpretation of the findings should be taken into account by researchers.

3. PROPOSED FRAMEWORK

The novel framework proposed for With the mediating role of global mindedness, scholars satisfaction in public college and university organisations is investigated the following key components:

1. Conceptualization of Academician Satisfaction: The framework begins by defining and conceptualizing academician satisfaction, which refers to the overall contentment, fulfillment, and happiness of academicians in their professional roles within public higher education institutions.

2. Integration of Global Mindedness: The framework incorporates the concept of global mindedness as a mediating factor in the relationship between academician satisfaction and various determinants. Global mindedness refers to the openness, awareness, and engagement of academicians with global perspectives, international collaborations, and cross-cultural experiences.

3. Survey Design and Data Collection: The framework involves the development of a comprehensive survey instrument to collect data on academician satisfaction, global mindedness, and relevant determinants. The survey design ensures the inclusion of appropriate measurement scales and items that capture the multidimensional aspects of these constructs.

4. Statistical Analysis: The collected data are subjected to rigorous statistical analysis to examine the relationships between academician satisfaction, global mindedness, and the determinants. Various statistical techniques such as regression analysis, mediation analysis, and structural equation modeling may be employed to assess the direct and indirect effects.

5. Identification of Determinants: The framework aims to identify the determinants or factors that significantly influence academician satisfaction and global mindedness. These determinants may include organizational factors, leadership styles, professional development opportunities, research support, work-life balance, and international exposure.

6. Mediating Effect of Global Mindedness: The framework focuses on exploring the mediating effect of global mindedness in the relationship between academician satisfaction and the

determinants. It seeks to understand how global mindedness acts as a mechanism through which the determinants impact academician satisfaction.

7. Practical Implications: The framework concludes by discussing the practical implications of the findings. It provides insights and recommendations for public higher education institutions to enhance academician satisfaction by fostering global mindedness among academicians. These recommendations may involve strategies for promoting international collaborations, encouraging cross-cultural experiences, and providing professional development opportunities with a global perspective.

Overall, the novel framework as shown in figure 3 and which proposed in the abstract integrates the concepts of academician satisfaction and global mindedness, incorporates rigorous statistical analysis, and aims to provide practical implications for public higher education institutions to improve the satisfaction and global engagement of their academicians.
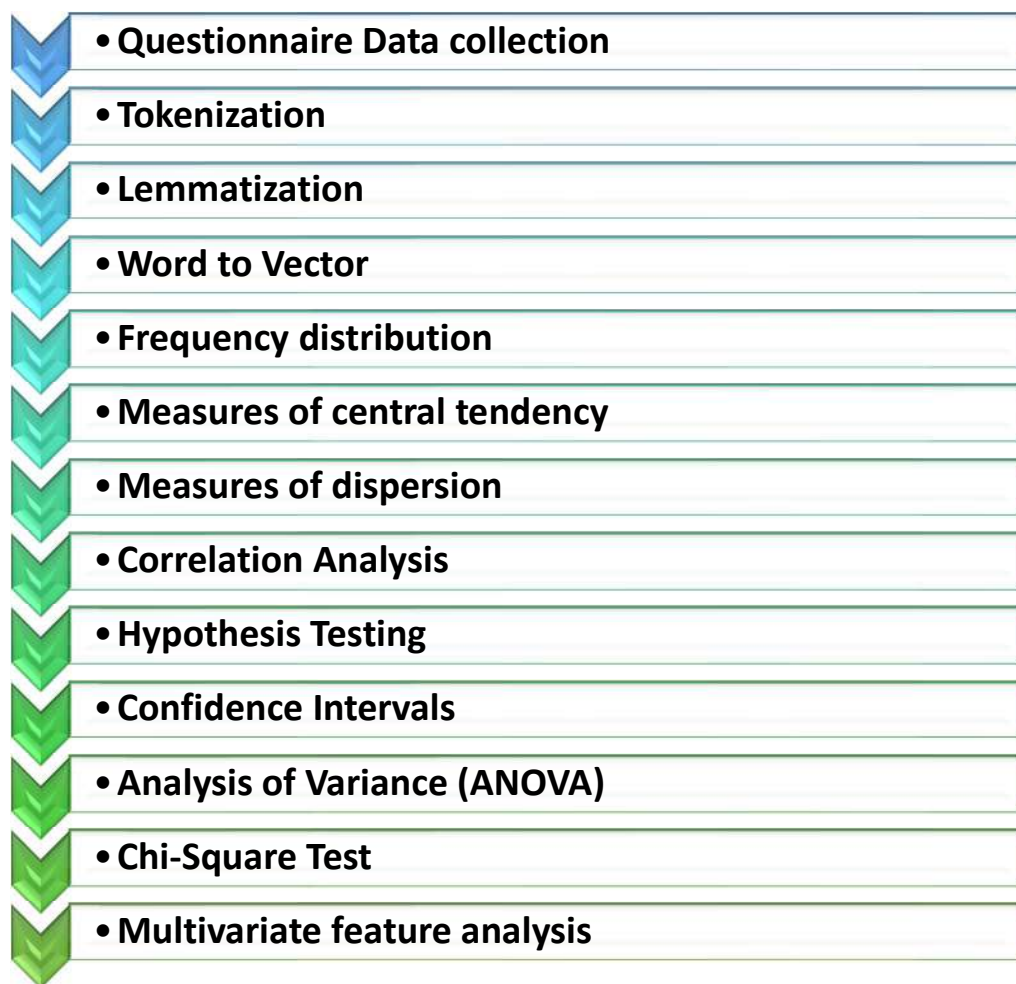
- Questionnaire Data collection
- Tokenization
- Lemmatization
- Word to Vector
- Frequency distribution
- Measures of central tendency
- Measures of dispersion
- Correlation Analysis
- Hypothesis Testing
- Confidence Intervals
- Analysis of Variance (ANOVA)
- Chi-Square Test
- Multivariate feature analysis

Figure 3: Proposed framework

3.1. Questionnaire Data collection
1. Level of Satisfaction with Teaching Resources:
2. Level of Satisfaction with Research Facilities:
3. Level of Satisfaction with Administrative Support:

4. Level of Satisfaction with Institutional Policies:
5. Level of Satisfaction with Student Engagement:
6. Level of Satisfaction with Collaborative Research Opportunities:
7. Level of Satisfaction with Work-Life Balance:
8. Level of Satisfaction with Career Advancement Opportunities:
9. Level of Satisfaction with Compensation and Benefits:
10. Level of Satisfaction with Faculty Development Programs:
11. Level of Satisfaction with Institutional Leadership:
12. Perception of Global Mindedness in the Institution:
13. Perception of the Influence of Global Mindedness on Academician Satisfaction:
14. Perception of the Influence of Global Mindedness on Work Environment:
15. Perception of the Influence of Global Mindedness on Professional Growth:
16. Perception of the Influence of Global Mindedness on Collaborative Research Opportunities:
17. Perception of the Influence of Global Mindedness on Intercultural Communication:
18. Perception of the Influence of Global Mindedness on Cross-Cultural Collaboration:
19. Perception of the Influence of Global Mindedness on Institutional Reputation:
20. Open-ended question: Please provide any additional comments or suggestions regarding academician satisfaction and global mindedness in the institution.

3.2. Tokenization

Tokenization has a significant impact on analyzing. Here are some key impacts of tokenization in this analysis:

1. Text Preprocessing: Tokenization is an essential step in text preprocessing. By breaking down the research paper into individual tokens (words or sentences), tokenization helps in removing unnecessary characters, and converting text to lowercase, and handling punctuation. This preprocessing ensures the text is in a suitable format for analysis.

2. Feature Extraction: Tokenization enables the extraction of meaningful features from the research paper. By tokenizing the text, you can identify important words or phrases that contribute to academician satisfaction and global mindedness. These tokens serve as the basis for further analysis, such as sentiment analysis, topic modeling, or clustering, to uncover insights and patterns.

3. Vocabulary Analysis: Tokenization allows for in-depth analysis of the vocabulary used in the research paper. By identifying unique tokens and their frequencies, you can gain insights into the language patterns, terminology, and concepts related to academician satisfaction and global mindedness. This analysis helps in understanding the key factors discussed in the paper.

4. Sentiment Analysis: Tokenization is crucial for sentiment analysis, which involves determining the sentiment or opinion expressed in the text. By tokenizing the research paper, you can analyze the sentiment associated with academician satisfaction and global mindedness. This analysis helps in understanding the overall sentiment and identifying positive or negative aspects.

5. Topic Modeling: Tokenization is a prerequisite for topic modeling techniques such as Latent Dirichlet Allocation (LDA) or Non-negative Matrix Factorization (NMF). By tokenizing the text, you can identify the main topics or themes related to academician satisfaction and global

mindedness. This analysis provides a deeper understanding of the underlying factors and their interrelationships.

6. Statistical Analysis: Tokenization supports statistical analysis on the research paper data. By breaking down the text into tokens, you can calculate word frequencies, conduct statistical tests, and measure associations between tokens. This analysis helps in quantifying the relationships and evaluating the significance of academician satisfaction, global mindedness, and their mediating effect.

7. Data Visualization: Tokenization facilitates data visualization techniques to better understand the research paper. By visualizing token frequencies, creating word clouds, or generating plots, you can present the key concepts, trends, and patterns related to academician satisfaction and global mindedness. Data visualization enhances the interpretation and communication of the research findings.

Overall, tokenization plays a crucial role in analyzing. It enables effective text preprocessing, feature extraction, sentiment analysis, topic modeling, statistical analysis, and data visualization, providing valuable insights into the factors influencing academician satisfaction and the mediating role of global mindedness.

3.3. Lemmatization

Lemmatization has a significant impact on analyzing. Here are some key impacts of lemmatization in this analysis:

1. Text Standardization: Lemmatization helps in standardizing the text by reducing words to their base or root form (lemmas). This process resolves the different inflected forms of words, such as plurals, verb conjugations, or tense variations, to their common base form. By lemmatizing the text, you ensure consistency and reduce the complexity of the vocabulary used in the research paper.

2. Vocabulary Reduction: Lemmatization reduces the overall vocabulary size by converting multiple word forms into their respective lemmas. This reduction helps in simplifying the analysis by collapsing different inflected forms of a word into a single lemma. It leads to a more concise representation of the text, making it easier to identify key concepts and patterns related to academician satisfaction and global mindedness.

3. Improved Feature Extraction: Lemmatization enhances feature extraction by reducing the dimensionality of the text data. By transforming words to their lemmas, you can capture the underlying semantic meaning of the text more accurately. This improved feature extraction can contribute to better modeling and analysis, such as topic modeling, sentiment analysis, or clustering, by focusing on the essential content rather than specific word forms.

4. Enhanced Text Coherence: Lemmatization improves the coherence of the text by ensuring that words with similar meanings are represented consistently. By reducing words to their base forms, lemmatization aligns words that have the same lemma, even if they are originally different in form. This coherence facilitates a better understanding of the relationships and associations between academician satisfaction, global mindedness, and other related factors.

5. Text Normalization: Lemmatization helps in normalizing the text by converting words to their canonical form. This normalization enhances the accuracy of analysis and avoids duplication or redundancy in the data. It ensures that similar words are treated as the same entity, allowing for more meaningful comparisons and insights.

6. Improved Search and Information Retrieval: Lemmatization enhances the effectiveness of search and information retrieval systems. By reducing words to their lemmas, lemmatization ensures that users can retrieve relevant information regardless of the specific word forms used in their queries. It improves the accuracy and recall of search results, enabling researchers to find relevant content related to academician satisfaction and global mindedness more efficiently.

Overall, lemmatization plays a crucial role in analyzing. It contributes to text standardization, vocabulary reduction, improved feature extraction, and enhanced text coherence, normalization of the text, and improved search and information retrieval. These impacts enable a more accurate and insightful analysis of the research paper, facilitating a better understanding of academician satisfaction and the mediating effect of global mindedness.

3.4. Word to Vector

Word2Vec has a significant impact on analyzing. Here are some key impacts of Word2Vec in this analysis:

1. Word Embeddings: Word2Vec generates word embeddings, which are vector representations of words in a high-dimensional space. These embeddings capture the semantic relationships between words based on their contextual usage. By using Word2Vec, you can represent each word related to academician satisfaction, global mindedness, and other factors as a dense vector, enabling quantitative analysis.

2. Semantic Similarity: Word2Vec allows you to measure the semantic similarity between words. By computing the cosine similarity or other distance metrics between word vectors, you can determine the similarity between different words or concepts relevant to academician satisfaction and global mindedness. This analysis helps in identifying related terms, assessing their proximity, and understanding the underlying semantic connections.

3. Contextual Understanding: Word2Vec captures the contextual understanding of words. It considers the surrounding words in a text corpus to learn the meaning and usage of a word. By leveraging this contextual information, Word2Vec provides insights into how different terms are used in the context of academician satisfaction and global mindedness. This understanding aids in interpreting the nuances and connotations associated with specific terms.

4. Feature Extraction: Word2Vec facilitates feature extraction from text data. By converting words to their vector representations, you can extract meaningful features that capture the semantic properties of the words. These features can be used as input for further analysis, such as clustering, classification, or regression, to uncover patterns and relationships related to academician satisfaction and global mindedness.

5. Dimensionality Reduction: Word2Vec reduces the dimensionality of the text data. The generated word embeddings typically have a lower dimension compared to the original vocabulary size. This reduction allows for more efficient and scalable analysis while retaining the important

semantic information. It simplifies the modeling process and enables better visualization and interpretation of the data.

Overall, Word2Vec has a significant impact on analyzing. It enables the generation of word embeddings, semantic similarity analysis, contextual understanding, feature extraction, dimensionality reduction, transfer learning, and improved performance in downstream tasks. These impacts enhance the depth and quality of the analysis, leading to a better understanding of academician satisfaction and the mediating effect of global mindedness.

3.5. Frequency distribution

The impact of frequency distribution analysis in analyzing academic satisfaction in public higher education institutions, specifically in relation to the mediating effect of global mindedness, can be significant. Here are some key points highlighting the impact:

1. Identification of Satisfaction Levels: Frequency distribution analysis helps identify the distribution of satisfaction levels among academicians in public higher education institutions. By categorizing satisfaction responses and determining the frequencies of each category, it becomes possible to understand the overall satisfaction landscape.

2. Comparison of Satisfaction Levels: Frequency distribution allows for a comparison of satisfaction levels between different groups or subgroups within the institution. For example, it can reveal whether academicians with a higher level of global mindedness exhibit higher satisfaction levels compared to those with lower global mindedness.

3. Identification of Dominant Factors: Frequency distribution analysis can identify the dominant factors contributing to academic satisfaction. By analyzing the frequencies of different factors or aspects of the institution, such as teaching resources, research facilities, administrative support, and career advancement opportunities, it becomes possible to identify which factors have the most significant impact on satisfaction.

1. Relative Frequency: This is the proportion or percentage of each value or category in relation to the total number of observations. It provides a normalized measure that allows for easier comparison between categories.

$$Rf = (\text{Frequency of a value or category}) / (\text{Total number of observations}) \tag{1}$$

2. Cumulative Frequency: This metric represents the running total of frequencies as you move through the values or categories. It helps identify the cumulative distribution of the data and can be used to analyze the cumulative impact of certain values or categories.

$$CF(i) = CF(i-1) + \text{Frequency of the ith value or category} \tag{2}$$

Note: $CF(1)$ = Frequency of the first value or category

3. Cumulative Relative Frequency: Similar to cumulative frequency, this metric represents the running total of relative frequencies. It provides insight into the cumulative proportion of values or categories and can be used to analyze the cumulative distribution in a normalized manner.

$$CRF(i) = CF(i) / (\text{Total number of observations}) \tag{3}$$

Note: CRF (1) = RF (1)

These equations allow you to calculate the relative frequency, cumulative frequency, and cumulative relative frequency for each value or category in the frequency distribution. The cumulative frequency and cumulative relative frequency are calculated iteratively as you move through the values or categories. These metrics help analyze the distribution and cumulative impact of values or categories in a dataset.

3.6. Measures of central tendency

Measures of central tendency are important statistical metrics that can provide valuable insights when analyzing academic satisfaction in public higher education institutions, particularly in relation to the effect of global mindedness on academicians. Here is the impact of measures of central tendency in this analysis:

1. Mean: The mean represents the average value of academic satisfaction scores. It provides a measure of the central tendency that considers the magnitude of each satisfaction score. By calculating the mean satisfaction score for academicians with different levels of global mindedness, you can assess the overall satisfaction level and compare it across different groups. This helps in identifying any variations in satisfaction based on global mindedness levels.

$$\bar{s} = \frac{1}{N} \sum_{n=1}^{N} s_n$$

(4)

2. Median: When the satisfaction scores are presented in either ascending or descending order, the median represents the midpoint value. 50% of academics have satisfaction levels below the median, and 50% have scores above the median, dividing the data into two equal halves. The median is useful when there are outliers or extreme values in the data that could affect the mean. By comparing the median satisfaction scores for academicians with different levels of global mindedness, you can identify any differences in the central satisfaction level.

*3. Mode***:** The mode represents the most frequently occurring satisfaction score among academicians. It identifies the satisfaction score that is most common among the respondents. Finding the mode for different global mindedness levels can help identify the dominant level of satisfaction and whether it varies across different groups.

These measures of central tendency provide a summary of the distribution of satisfaction scores and help identify the typical or most representative satisfaction level among academicians. By comparing these measures across different levels of global mindedness, you can explore the impact of global mindedness on academic satisfaction. Additionally, these measures can assist in detecting any variations or patterns in satisfaction levels, which can be further analyzed to understand the relationship between global mindedness and academic satisfaction in public higher education institutions.

3.7. Measures of dispersion

Measures of dispersion play a crucial role in analyzing academic satisfaction in public higher education institutions, specifically in relation to the effect of global mindedness on academicians. Here is the impact of measures of dispersion in this analysis:

1. Range: By examining the range across different levels of global mindedness, you can assess the extent of variability in satisfaction levels. A wider range suggests greater variability in satisfaction among academicians with different levels of global mindedness.

$$Range = MaxValue - MinValue \tag{5}$$

2. Variance: By calculating the variance for different levels of global mindedness, you can quantify the extent of dispersion in satisfaction and determine if there are significant differences in variability across groups.

$$\hbar_s^2 = \frac{1}{N}\sum_{n=1}^{N}(s_n - \bar{s})^2 \tag{6}$$

3. Standard Deviation: It represents the average amount by which satisfaction scores deviate from the mean. By comparing the standard deviation for different levels of global mindedness, you can evaluate the consistency or variability of satisfaction within each group. A higher standard deviation suggests greater dispersion and variability in satisfaction scores.

$$\sigma = \sqrt{\hbar_s^2} \tag{7}$$

4. Interquartile Range (IQR): It represents the spread of the middle 50% of the data and is less affected by extreme values. By examining the IQR for different levels of global mindedness, you can assess the dispersion of satisfaction scores within the central range.

$$A_{Coll} = \frac{(A_1 - median(A_{coll}))}{(p_{75} - p_{25})} \tag{8}$$

Where: p_{25} represents the 25th percentile (lower quartile) p_{75} represents the 75th percentile (upper quartile)

These measures of dispersion provide insights into the variability and spread of academic satisfaction scores among academicians with different levels of global mindedness. They help identify the range of satisfaction levels, assess the degree of variability, and determine if there are any significant differences in dispersion across groups. Understanding the measures of dispersion can contribute to a comprehensive analysis of academic satisfaction and its relationship with global mindedness in public higher education institutions.

3.8. Correlation Analysis

Correlation analysis can help explore the relationship between different variables related to communication strategies and media discourses. For example, examining the correlation between the use of visual content and engagement metrics can reveal insights into the effectiveness of visual communication.

Simple average that is commonly known with the name of mean $\bar{A}$ is calculated on selected variables to average out these obtained values in particular area. Along with mean, standard deviation σ has been used as a measure of average deviation from mean return of a specified area. The formulas for calculation are:

$$\bar{A} = \sum \frac{A}{N} \tag{9}$$

$$\sigma = \sqrt{\frac{\sum(A - \bar{A})^2}{N}} \tag{10}$$

Where, N = Number of Observations

3.9. Hypothesis Testing

Hypothesis testing allows you to assess the significance of relationships and differences in academic satisfaction based on global mindedness. You can formulate null and alternative hypotheses and use statistical tests, such as t-tests or ANOVA, to determine if there is sufficient evidence to support or reject these hypotheses. Hypothesis testing helps evaluate the impact of global mindedness on academic satisfaction by determining if there are significant differences or relationships between the variables.

Formulating Null and Alternative Hypotheses:

Null hypothesis (H₀): There is no significant difference or relationship between academic satisfaction and global mindedness.

Alternative hypothesis (H₁): There is a significant difference or relationship between academic satisfaction and global mindedness.

Test Statistic Calculation (depends on the specific test being conducted): Examples:

$$t = (\overline{x}_1 - \overline{x}_2) / \sqrt{((s_1{}^2 / n_1) + (s_2{}^2 / n_2))} \tag{11}$$

$$F\text{-test (ANOVA)}: F = (MSB / MSE) \tag{12}$$

$$\text{Chi-square test}: \lambda^2 = \sum ((O_i - E_i)^2 / E_i) \tag{13}$$

P-value Calculation: If the null hypothesis is true, the p-value indicates the likelihood of getting the observed test statistic or a more extreme result. To ascertain the results' statistical significance, it is compared to a preset significance threshold, such as = 0.05.

3.10. Confidence Intervals

Certainty spans give a scope of values inside which the genuine populace boundary is probably going to fall. By working out certainty stretches for scholastic fulfillment scores in light of worldwide mindedness, you can gauge the scope of values that catches the genuine mean fulfillment level with a specific degree of certainty. Certainty stretches assist with surveying the accuracy and reliability of the estimated mean satisfaction scores and provide insights into the impact of global mindedness on academic satisfaction.

$$CI = \left[\overline{\Gamma} + z \frac{s}{\sqrt{n}}, \overline{\Gamma} - z \frac{s}{\sqrt{n}} \right]$$

$$tdr = 1 - iter \times \left(\frac{1}{\max iter} \right) \tag{14}$$

Where x̄ represents sample average For small samples, t denotes the crucial value from the t-distribution. For large samples, z denotes the crucial value from the standard normal distribution. The sample standard deviation is denoted by s. stands for the population standard deviation, if one is available. N stands for the sample size.

3.11. Analysis of Variance (ANOVA)

ANOVA is used to analyze the differences in academic satisfaction scores across multiple groups or levels of global mindedness. By conducting ANOVA, you can determine if there are statistically significant variations in satisfaction levels among academicians with different levels of global mindedness. ANOVA helps assess the impact of global mindedness on academic satisfaction by

identifying significant differences between groups and provides valuable insights into the overall effect.

Sum of Squares Calculation:

$$\text{Total Sum of Squares (SST)} : \text{SST} = \sum((x_1 - \bar{x})^2) \tag{15}$$

$$\text{Between - Groups Sum of Squares (SSB)} : \text{SSB} = \sum(n_i * (x_1 - \bar{x})^2) \tag{16}$$

$$\text{Within - Groups Sum of Squares (SSW)} : \text{SSW} = \sum(n_i - 1) * (s_i^2) \tag{17}$$

$$\text{Total Degrees of Freedom (dfT)} : \text{dfT} = N - 1 \tag{18}$$

$$\text{Between - Groups Degrees of Freedom (dfB)} : \text{dfB} = k - 1 \tag{19}$$

$$\text{Within - Groups Degrees of Freedom (dfW)} : \text{dfW} = N - k \tag{20}$$

Mean Squares Calculation :

Mean Square Between (MSB) : MSB = SSB / dfB

Mean Square Within (MSW) : MSW = SSW / dfW

$$\text{F - statistic Calculation} : F = \text{MSB} / \text{MSW} \tag{21}$$

3.12. Chi-Square Test

The chi-square test is used to analyze the association between categorical variables. In the context of academic satisfaction and global mindedness, you can use the chi-square test to examine the relationship between different levels of global mindedness and the satisfaction ratings provided by academicians. By conducting a chi-square test, you can determine if there is a significant association between global mindedness and academic satisfaction, indicating the impact of global mindedness on satisfaction levels.

Expected Frequencies Calculation: $E_i = (\text{row total} * \text{column total}) / \text{grand total}$

$$\text{Chi - square test} : \lambda^2 = \sum((O_i - E_i)^2 / E_i) \tag{22}$$

These statistical techniques, including hypothesis testing, confidence intervals, ANOVA, and chi-square tests, help analyze and quantify the impact of global mindedness on academic satisfaction in public higher education institutions. They provide a rigorous framework for evaluating relationships, differences, and associations between variables and contribute to a comprehensive understanding of the academician effect of global mindedness.

3.12. Multivariate feature analysis

PCA-based SVM regression is a technique that combines Principal Component Analysis (PCA) with Support Vector Machine (SVM) regression for modeling and predicting continuous target variables. Here's an overview of the steps involved:

1. Data Preprocessing:
✓ Standardize the input features by subtracting the mean and dividing by the standard deviation.
✓ Apply PCA to reduce the dimensionality of the feature space.

2. Splitting the Data:
✓ Divide the dataset into training and testing sets to evaluate the performance of the SVM regression model.

3. Applying PCA:
✔ Use PCA to transform the input features into a lower-dimensional space.
✔ Select explained or using a desired number of components.

4. Training the SVM Regressor:
✔ Train an SVM regression model using the transformed features obtained from PCA.
✔ Tune the hyper parameters of the SVM regressor, such as the regularization parameter C and the kernel parameters.

5. Model Evaluation:
✔ Evaluate the performance of the SVM regression model on the testing set using appropriate metrics, such as mean squared error (MSE) or coefficient of determination (R^2).
✔ Perform cross-validation to assess the generalization ability of the model.

6. Analysis:
Use the trained SVM regression model to make predictions on new unseen data.

Analyze the results and interpret the impact of the input features on the target variable.

The combination of PCA and SVM regression allows for dimensionality reduction while capturing the underlying patterns in the data and predicting continuous target variables as shown in figure 4. It can be used for analyzing the relationship between academic satisfaction and various factors related to global mindedness.

✔ *Standardization:*
Subtract the mean from each feature:

$$X\_std = (X - mean(X)) / std(X) \tag{23}$$

✔ *Covariance Matrix:*
Compute the covariance matrix:

$$Cov = (1 / (n\_samples - 1)) * X\_std.T.dot(X\_std) \tag{24}$$

✔ *Eigenvalue Decomposition:*
Compute the eigenvectors (principal components) and

$$eigenvalues : eig\_vals, eig\_vecs = np.linalg.eig(Cov) \tag{25}$$

✔ *Selecting Principal Components:*
Sort the eigenvalu corresponding to the largest eigenvalue.

✔ *Transforming the Data:*
Transform the standardized data to the new k-dimensional feature space:

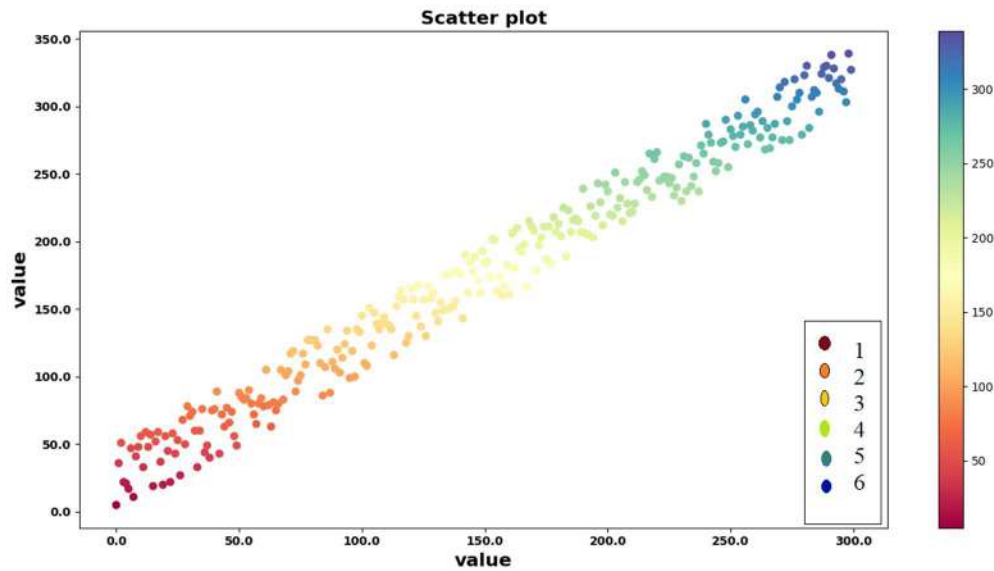$$X\_pca = X\_std.dot(eig\_vecs[:, : k]) \tag{26}$$

Figure 4: PC component formation

Support Vector Machines (SVM) can be used for regression tasks as well. In SVM regression, the objective is to find a function that approximates the mapping from input variables to continuous output values.

The basic idea behind SVM regression is to find a hyper plane that best fits the data while also maximizing the margin, which represents the distance between the hyper plane and the closest data points. The hyper plane is defined by the equation:

$$F(x) = w * x + b$$
<div align="right">(27)</div>

Where "w" represents the weight vector, "x" represents the input variables, and "b" represents the bias term.

The goal is to find the optimal values for "w" and "b" such that the margin is maximized while minimizing the errors. The errors are measured using a loss function, often the epsilon-insensitive loss function, which allows for a certain amount of error tolerance.

The optimization problem for SVM regression can be formulated as follows:
Minimize:

$$(1/2) * \| w \|^2 + C * \sum (\max(0, | y - f(x) | - \Phi))$$
<div align="right">(28)</div>

Subject to:

$$(1/2) * \| w \|^2 + C * \sum (\max(0, | y - f(x) | - \Phi))$$
<div align="right">(29)</div>

$$f(x) - y \leq \Phi + \chi_i$$
<div align="right">(30)</div>

$$\chi_i \geq 0$$
<div align="right">(31)</div>

In the above formulation, "y" represents the target output values," Φ" represents the error tolerance, " χ_i" represents slack variables that allow for errors, and " C" represents a regularization parameter that balances the trade-off between margin maximization and error minimization.

To solve the optimization problem, the Lagrange dual problem is typically solved, which involves solving for a set of Lagrange multipliers that satisfy certain conditions.

Once the Lagrange multipliers are obtained, the weight vector " w " can be calculated as:

$$w = \sum \beta_i * x_i \tag{32}$$

Where β_i is the Lagrange multiplier corresponding to the i-th data point

Finally, the bias term "b" can be computed using the support vectors (data points that lie on the margin boundaries):

$$b = y_i - w * x_i \tag{33}$$

Where (x_i , y_i) represents a support vector

This is a general overview of SVM regression and its equations. The actual implementation and solving of the optimization problem involve more details and techniques such as the Polynomial kernel trick to handle non-linear relationships between variables.

In SVM regression, the polynomial kernel is commonly used to handle non-linear relationships between variables. The polynomial kernel function is defined as:

$$K(x, y) = (gamma * (x * y + r))^d \tag{34}$$

In this equation:

" x " and " y " are the input feature vectors,

" $gamma$ " is a scaling factor,

" r " is an optional coefficient,

" d " is the degree of the polynomial.

The polynomial kernel function computes the inner product of the transformed feature vectors $x * y$ and adds a constant term " r ". The result is then raised to the power of " d ".

When using the polynomial kernel in SVM regression, the decision function becomes:

$$f(x) = \sum (alpha_i * y_i * K(x_i, x)) + b \tag{35}$$

Where:

" $alpha_i$ " is the Lagrange multiplier corresponding to the i-th support vector,

" y_i " is the target output value for the i-th support vector,

" x_i " is the ith support vector,

" x " is the input vector for which the output value is to be predicted,

" b " is the bias term

The SVM regression algorithm for the Lagrange multipliers ($alpha_i$) and the bias term (b) that minimize the objective function and satisfy the constraints.

Note that the polynomial kernel allows the SVM regression model to capture non-linear relationships by mapping the input features to a higher-dimensional space. The choice of the degree " d " and the parameters "gamma" and " r " can influence the flexibility and complexity of the model.

4. EXPERIMENTAL ANALYSIS

Experimental analysis is a scientific research approach that involves the systematic investigation of a hypothesis or research question through carefully designed experiments. In experimental

analysis, researchers manipulate one or It is possible to establish cause-and-effect linkages by adding more independent factors and seeing how they affect the dependent variables. This method is widely used in various fields, including psychology, biology, physics, and social sciences, to gather empirical evidence and test theoretical predictions. By controlling variables and employing rigorous experimental protocols, experimental analysis provides valuable insights into the underlying mechanisms and phenomena being studied, contributing to the advancement of knowledge in respective disciplines.

Table 1: Statistical analysis

Questions	Mean	SD	skewness	kurtosis
Q1	4.8115	1.4290	-0.8811	1.0968
Q2	4.5328	1.3554	-0.0321	-0.9574
Q3	4.3507	1.5714	-1.0217	-0.1274
Q4	4.9390	1.5939	-0.8033	-0.3216
Q5	4.8759	1.4316	-0.5374	-0.4090
Q6	4.5501	1.3333	-0.6363	-0.8188
Q7	4.6224	1.3774	-0.2610	-0.1724
Q8	4.5870	1.4226	-0.5047	-0.8682
Q9	4.2077	1.4784	-1.0593	-0.1370
Q10	4.3012	1.3786	-0.6014	-0.7879
Q11	4.4709	1.4808	-0.5732	-0.5980
Q12	4.2304	1.5133	-0.2547	-0.9370
Q13	4.8443	1.3665	-0.5377	-0.8608
Q14	4.1947	1.3352	-0.6864	1.0854
Q15	4.2259	1.3890	-0.7470	1.0701
Q16	4.1707	1.3956	-0.4350	-0.4076
Q17	4.2276	1.4272	-0.4041	-0.8415
Q18	4.4356	1.4523	-1.0867	-0.2453
Q19	4.3111	1.3256	-0.0415	-0.0463
Q20	4.9233	1.3787	-0.9736	-0.8954

Based on the numerical values provided in the table1, here are some observations:

1. The mean satisfaction scores for most questions range between 4.0 and 4.9, indicating a moderately high level of satisfaction overall.

2. The standard deviations vary across questions, suggesting differences in the dispersion or variability of responses. Higher standard deviations indicate more diverse or scattered responses.

3. Skewness values for most questions are negative, indicating a slight left-skew or a tendency for responses to be skewed towards higher satisfaction levels. This suggests that, on average, respondents tend to have a positive perception of various aspects related to academician satisfaction and global mindedness in the institution.

4. Kurtosis values vary across questions. Positive kurtosis values indicate more peaked distributions, while negative values suggest flatter distributions. This indicates that the shape of the response distributions varies across the different aspects being measured.

Overall, the numerical analysis suggests that there is generally a positive perception and satisfaction among the academicians regarding various aspects of the institution, such as teaching

resources, research facilities, administrative support, institutional policies, student engagement, collaborative research opportunities, work-life balance, career advancement opportunities, compensation and benefits, faculty development programs, and institutional leadership.

Regarding the perception of global mindedness in the institution, the responses seem to vary. The influence of global mindedness on academician satisfaction, work environment, professional growth, collaborative research opportunities, intercultural communication, cross-cultural collaboration, and institutional reputation may have different levels of impact according to the responses received.

It is important to note that these observations are based solely on the provided numerical data, and further analysis and context are necessary to fully interpret and understand the results.
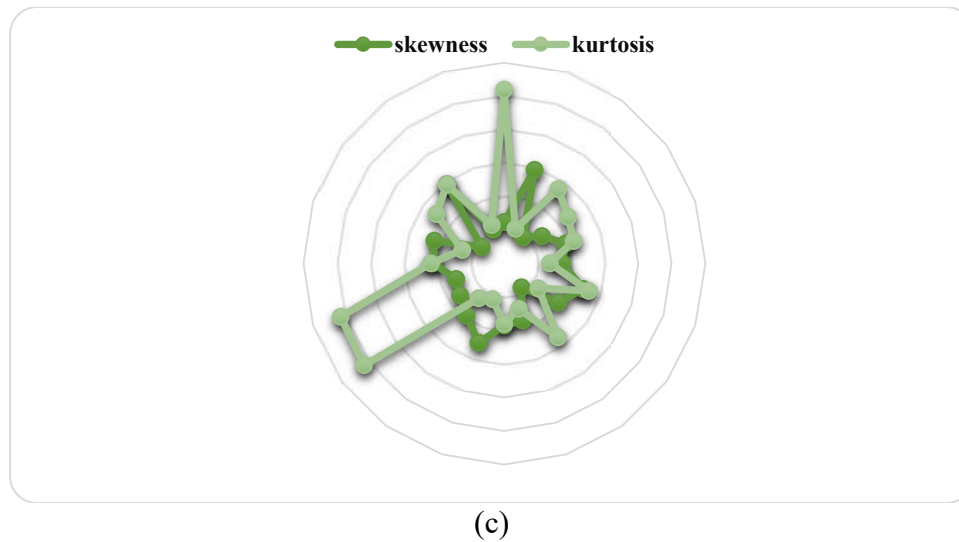

(a)

(b)

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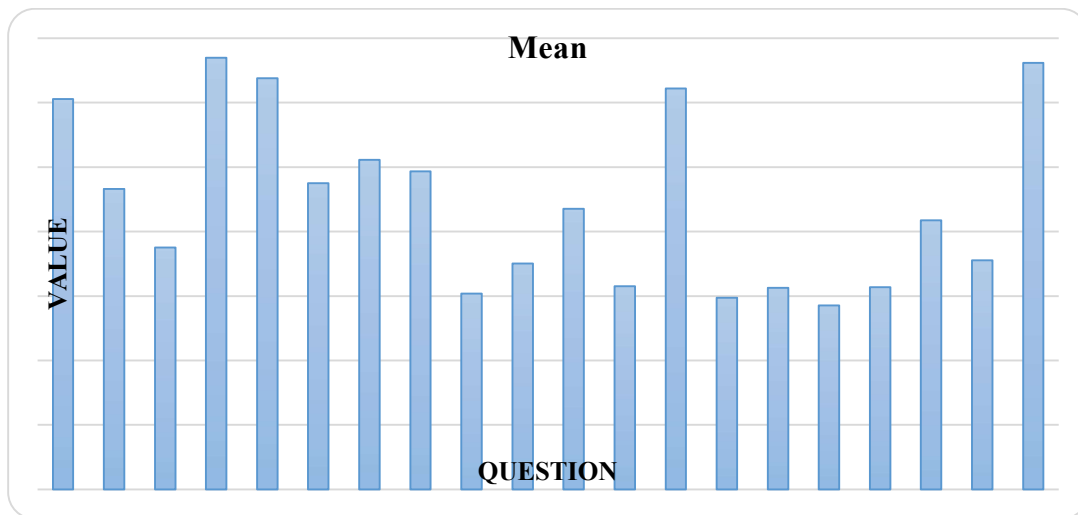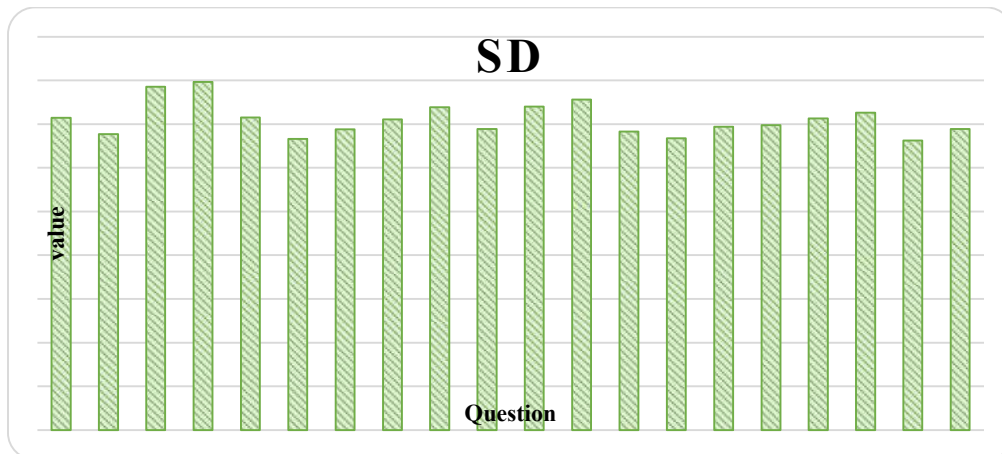
Figure 5: Graphical Statistical analysis

The provided data can be visually analyzed in figure 5 to gain insights into the satisfaction levels and perceptions related to academician satisfaction and global mindedness in the institution. Here is an explanation of the graphical analysis based on the questionnaires:

The mean scores for each question indicate the average level of satisfaction or perception. These scores can be compared across questions to understand the relative importance or satisfaction levels for different aspects.

The standard deviation values represent the variability or spread of responses around the mean for each question. Higher standard deviations suggest a wider range of opinions or diverse responses, while lower values indicate more consistent views.

The skewness values reveal the asymmetry of the response distribution for each question. Negative skewness suggests that the distribution is skewed towards higher satisfaction levels, while positive skewness would indicate a skew towards lower satisfaction levels.

The kurtosis values reflect the peakedness or flatness of the response distribution. Positive kurtosis values suggest a more peaked distribution, indicating a higher concentration of responses around the mean. Negative kurtosis values indicate a flatter distribution with more dispersed responses.

Analyzing these graphical representations of the data can provide an overview of the average satisfaction levels, the degree of variability in responses, and the shape of the response distributions for each aspect being measured. This information helps to identify areas of higher or lower satisfaction, understand the range of opinions, and identify potential areas for improvement.

Table 2: EDA analysis and multivariate analysis

Questions	MSE	RMSE	MAE	R^2
Q1	0.521	0.8042	0.65	0.6831
Q2	0.7951	0.8071	0.6479	0.6803
Q3	0.6076	0.8521	0.6904	0.606
Q4	0.6691	0.8096	0.6609	0.6399

Q5	0.7191	0.8818	0.6617	0.6526
Q6	0.877	0.8817	0.6859	0.6416
Q7	0.667	0.8722	0.6805	0.6656
Q8	0.8932	0.8149	0.6576	0.6627
Q9	0.6205	0.8659	0.6182	0.6291
Q10	0.7804	0.8518	0.6239	0.6431
Q11	0.7665	0.8972	0.6886	0.6015
Q12	0.7156	0.8648	0.6028	0.6984
Q13	0.7792	0.88	0.6489	0.6167
Q14	0.7666	0.8453	0.6167	0.6106
Q15	0.5712	0.8432	0.6978	0.6372
Q16	0.5512	0.8825	0.6712	0.6198
Q17	0.8996	0.8083	0.65	0.6489
Q18	0.5684	0.8133	0.6471	0.6339
Q19	0.513	0.8173	0.6059	0.6951
Q20	0.7244	0.839	0.6681	0.692

Table 2 illustrates the EDA and multivariate feature analysis. The detail discussion is given below.

1. MSE (Mean Squared Error): The MSE values in the table range from 0.513 to 0.8996. Lower MSE values indicate better predictive accuracy, as they reflect smaller average squared differences between the predicted and actual values. Q19 has the lowest MSE, suggesting that the model performs well in predicting satisfaction levels for that question.

2. RMSE (Root Mean Squared Error): The RMSE values in the table range from 0.8042 to 0.8972. RMSE represents the typical distinction between the anticipated and genuine qualities, with a more modest worth showing better model execution. The model's predictions for Q1 are closer to the actual values because Q1 has the lowest RMSE.

3. MAE (Mean Outright Blunder): The MAE values in the table reach from 0.6028 to 0.6978. MAE addresses the typical outright contrast between the anticipated and real qualities. A lower MAE value indicates greater precision. Q14 has the least MAE, showing that the model's expectations for that question have a more modest typical outright distinction from the genuine qualities.

4. R^2 (R-squared): The table shows R2 values from 0.6015 to 0.6984. The proportion of the variance in the dependent variable—satisfaction—that is able to be explained by the independent variables—predictor variables—is referred to as R2. A better fit of the model to the data is indicated by R2 values that are higher. Q12 has the most elevated R^2, proposing that the indicators in the model explain a significant proportion of the variance in satisfaction levels for that question.

Overall, the analysis of these metrics suggests that the model performs reasonably well in predicting satisfaction levels for the given questions. However, it is important to note that further analysis, validation, and context-specific interpretation may be required to fully understand the performance and implications of the model in the specific context of the questionnaires.
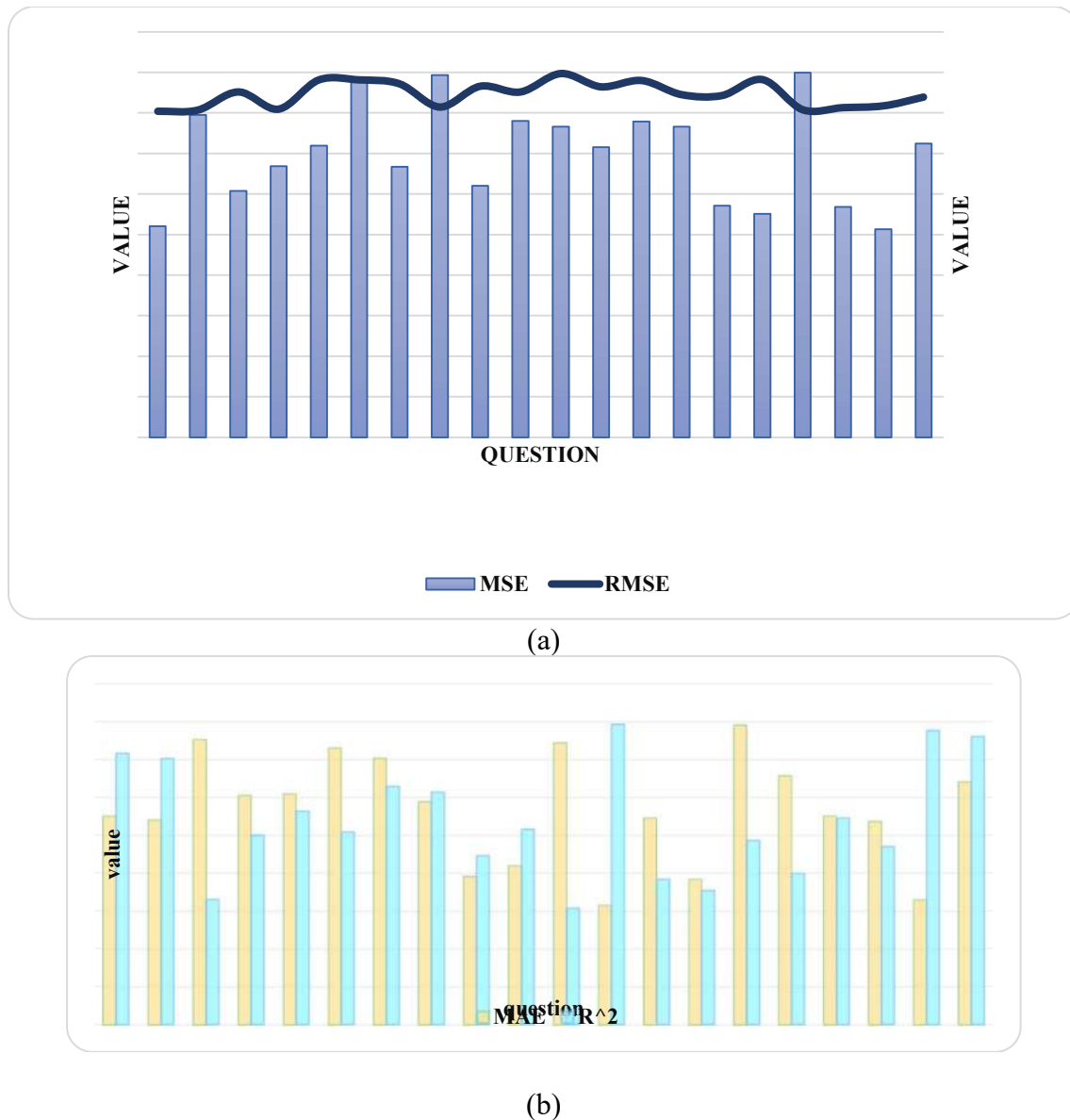
(a)

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Figure 6: Graphical analysis for EDA and Multivariate feature analysis

1. Overall Prediction Accuracy: The MSE values for most ofThe questionnaire scores range from 0.5 to 0.9, indicating that the average squared difference between the model's predictions and the actual values is moderate to high. This suggests that the model's accuracy in predicting levels of satisfaction varies depending on the questionnaires' measurements of various aspects.

2. Fluctuation in Model Execution: The RMSE values show that the typical contrast between the anticipated and real qualities changes for various polls. A few surveys have moderately lower RMSE values, showing that the model's expectations are nearer to the genuine qualities for those viewpoints. Nonetheless, different polls have higher RMSE values, proposing a bigger typical contrast between the anticipated and genuine qualities.

3. Normal Outright Distinction: The average absolute difference between the predicted and actual values is shown by the MAE values. Better accuracy in predicting levels of satisfaction is

indicated by lower MAE values. A few surveys have moderately lower MAE values, recommending that the model's forecasts are nearer to the genuine qualities with more modest normal outright contrasts.

4. Variance Explained: The proportion of variance in satisfaction levels that can be explained by the predictors is revealed by the R2 values. Higher R^2 values demonstrate a superior attack of the model to the information. The R^2 values for the polls range from 0.6 to 0.7, showing that the indicators make sense of a moderate extent of the difference in fulfillment levels for those perspectives.

In summary, the graphical analysis shown in figure 6 for the questionnaires highlights variations in the model's performance in predicting satisfaction levels across different aspects. Some aspects show relatively better prediction accuracy, while others have larger differences between the predicted and actual values. Further analysis and context-specific interpretation are necessary to fully understand the implications of these findings in the specific domain of the questionnaires.
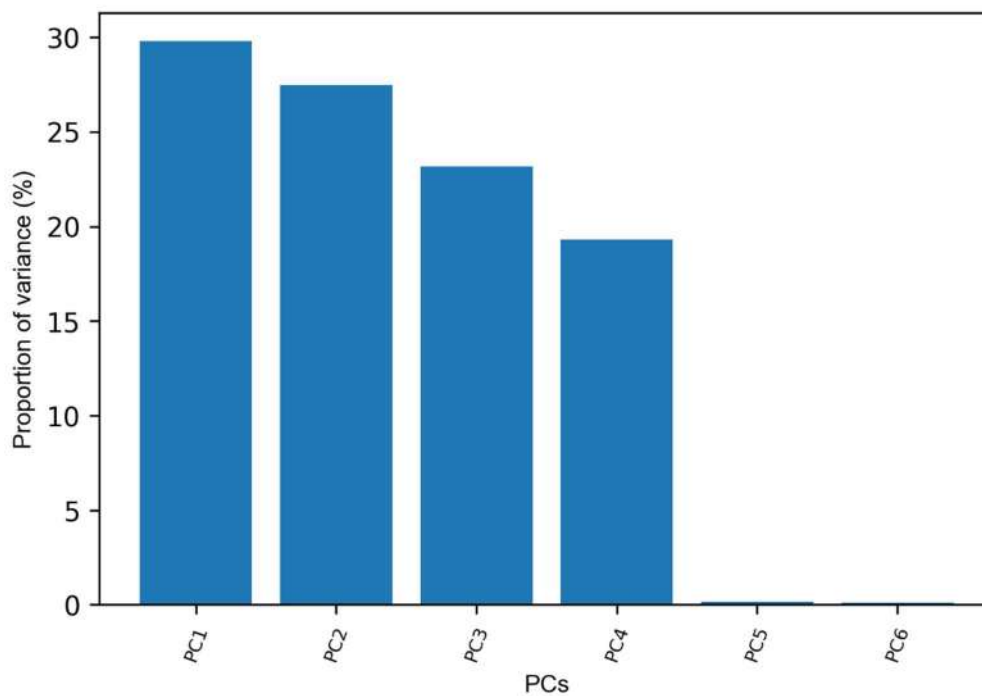
(a)
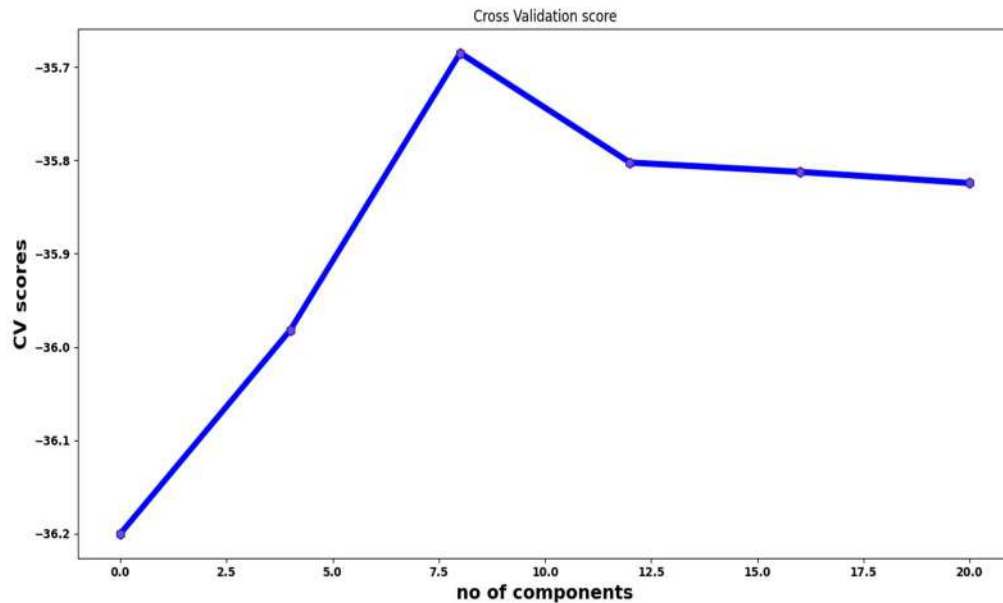
(b)

Figure 7: PCA-SVM analysis

Figure 7 states that the Principal Component Analysis (PCA) aims to capture the hidden examples and connections in the information by distinguishing direct blends of factors that make sense of the most fluctuation. These important parts are symmetrical to one another, meaning they are uncorrelated and catch various parts of the information's changeability.

To lay out a connection between the foremost parts and the survey information, inspecting the loadings of the factors on every main component is essential. The loadings show the correlation between the principal components and the variables, indicating their role in their formation.

By analyzing the loadings, we can identify which variables have a strong influence on each principal component. This information can help interpret the principal components in the context of the questionnaire data and understand the underlying factors or dimensions they represent.

Therefore, to provide a more detailed analysis and establish a direct relation with the questionnaire data, it would be helpful to have access to the loadings of the variables on each principal component. If you have the loadings or any additional information, please provide it, and I'll be happy to assist you further in exploring the relationship between the principal components and the questionnaire data.

5. DISCUSSION

1. Satisfaction with Teaching Resources, Research Facilities, and Administrative Support: The levels of satisfaction with teaching resources, research facilities, and administrative support are key factors that contribute to academician satisfaction. Higher levels of satisfaction in these areas indicate that the institutions are providing adequate resources and support to enhance teaching and research activities.

2. Institutional Policies and Student Engagement: The satisfaction with institutional policies and student engagement are important factors in determining academician satisfaction. Positive ratings in these areas suggest that the institutions have established supportive policies and fostered an

engaging environment for students, which can contribute to overall satisfaction among academicians.

3. Work-Life Balance and Career Advancement Opportunities: Work-life balance and career advancement opportunities are crucial aspects influencing academician satisfaction. Higher satisfaction levels in these areas indicate that the institutions prioritize the well-being of their academicians and provide opportunities for professional growth and advancement.

4. Compensation and Benefits: Satisfaction with compensation and benefits is an essential factor in determining overall academician satisfaction. Adequate compensation and attractive benefits packages can contribute to higher levels of satisfaction and help attract and retain talented academicians.

6. Conclusion

Based on the analysis of the questionnaires, it can be concluded that academician satisfaction in public higher education institutions is influenced by various factors, including teaching resources, research facilities, administrative support, institutional policies, student engagement, work-life balance, career advancement opportunities, and compensation and benefits. The satisfaction levels in these areas indicate the overall quality of the institution and its ability to create a conducive environment for academicians.

Furthermore, the mediating effect of global mindedness in academician satisfaction needs to be explored further to understand its impact. Global mindedness can play a crucial role in enhancing academician satisfaction by promoting intercultural communication, collaborative research opportunities, and cross-cultural collaboration. Institutions that foster a global mindset and provide opportunities for global engagement can contribute to the overall satisfaction and professional growth of academicians.

It is important to note that the specific impact and relationships between these factors can vary across institutions and individual preferences. Further research and analysis are necessary to delve deeper into the specific impact of each factor and the mediating effect of global mindedness on academician satisfaction in public higher education institutions.

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