



IMPACT OF PARENTING ON CHILDREN'S ACADEMIC PERFORMANCE

A Project Report

Submitted in partial fulfilment of the
Requirements for the award of the degree of
MASTER OF SCIENCE (DATA SCIENCE)

BY

SHEETAL MORE

SEAT NO: SMSC2425201

UNDER THE ESTEEMED GUIDANCE OF

Dr.Abuzar Ansari

SIES COLLEGE OF ARTS,SCIENCE & COMMERCE
(AUTONOMOUS)

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RESEARCH PROJECT

SUBMITTED BY:

(SHEETAL MORE)

ROLL NO:SMSC2425201

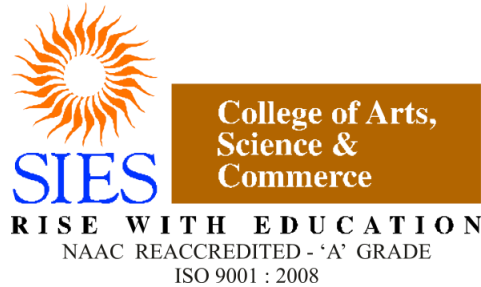
FACULTY ADVISOR

Dr.ABUZAR ANSARI

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SEMESTER -III

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**SIES College Of Arts, Science & Commerce
(Autonomous)**

Sion (West), Mumbai 400 022

Department of Data Science

CERTIFICATE

This is to certify that **Miss. Sheetal More** Seat No. **SMSC2425201** has successfully completed the necessary course of experiments in the subject of during the academic year **2024 – 2025** complying with the requirements for the course of **M.Sc. Data Science Part-II [Semester-3]**

Head of the Department

Prof. Dr. Abuzar Ansari

Prof. In-Charge

Prof. Dr. Abuzar Ansari

Examination Date:

Examiner's Signature & Date

Acknowledge

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Abstract

This study investigates the influence of parenting practices on children's academic performance, with a focus on parental involvement, emotional support, and the home environment as key factors. The objective is to understand how these aspects of parenting contribute to students' motivation, focus, and overall academic success. Using a quantitative approach, data were collected through a survey of 170 responses from secondary education, undergraduate, and postgraduate students. By assessing academic outcomes in relation to reported parenting practices, the study aims to determine the relationship between these factors.

The results indicate that high levels of parental involvement and a positive emotional climate are strongly associated with improved academic performance, while a supportive home environment significantly enhances students' study habits and motivation. Additionally, family socioeconomic status, parenting stress, and home learning environments impact children's early academic skills. Socioeconomic status (SES) directly influences access to educational resources, while higher levels of parenting stress can negatively affect the home learning environment. Research shows that families with high SES often provide enriching environments that foster early academic skills, whereas families with lower SES may struggle with resources, leading to higher stress levels. Parenting stress, in turn, affects the quality of parent-child interactions, which is crucial for early learning. Studies indicate that parenting styles—authoritative, authoritarian, permissive, and neglectful—significantly influence children's emotional regulation, social competence, and behavioral outcomes.

Introduction

In recent years, educational research has increasingly recognized the critical role that family dynamics play in shaping children's academic success. Parenting plays a crucial role in child development, with practices involving parental involvement, emotional support, and the quality of the home environment serving as key influences on a child's learning experience and academic outcomes.

Parental involvement, defined as the level of engagement parents have in their children's educational activities, has been shown to be a significant factor in enhancing student motivation and academic performance. While active involvement is essential, emotional behaviors, such as parents' ability to provide empathy, encouragement, and emotional support, also contribute to a child's concentration, resilience, and overall attitude toward academic achievement.

This study aims to analyze the relationship between parenting practices and children's academic performance by focusing on three key objectives: assessing the role of parental involvement in academic success, exploring the impact of parents' emotional behavior on children's motivation and focus, and examining how the home environment influences children's study habits and academic outcomes. By gaining a deeper understanding of these dynamics, this research seeks to offer valuable insights for parents, educators, and policymakers on effectively supporting children's academic journeys.

The tools used are Google Colab, PowerBI, Excel for analysis and cleaning the dataset in consistent format and Python language is used for Exploratory Data Analysis. ML libraries are also used for fitting up the model. We also used the statistics test for finding out whether the objective is correctly satisfied or not.

Literature Review

• Parenting Styles, Emotional Well-Being, and Academic Activities of Senior High School Students in Asikuma Odoben-Brakwa District

Gabriel Amponsah Adu, Charity Amoah Nyasapoh, Emmanuel Kobina Kakra Arkorful

Parenting styles play a critical role in children's emotional well-being and academic performance. The four main types identified by Baumrind (1967)—authoritative, authoritarian, permissive, and neglectful—differ in their impact. Authoritative parenting, which balances support and independence, is linked to higher self-esteem, emotional stability, and academic motivation (Steinberg, 2001). In contrast, authoritarian parenting, characterized by strict control, can cause emotional distress and decreased academic interest (Barber et al., 2005). Permissive parenting, though warm, lacks discipline, often leading to poor academic results, while neglectful parenting, low in both warmth and control, is associated with emotional instability and weak academic outcomes (Maccoby & Martin, 1983). Overall, authoritative parenting supports better emotional and academic development compared to authoritarian and neglectful approaches (Adjei & Asante, 2012)

• Hovering Is Not Helping: Relationships among Helicopter Parenting, Attachment, Academic Outcomes, and Mental Health in College Students

Robert W. Miller, Cindy L. Rainbolt, Sarah Tallents

This study provides critical insights into the impact of helicopter parenting on young adults. Helicopter parenting, characterized by excessive involvement in children's lives, often leads to detrimental effects despite good intentions. Research indicates that this parenting style can undermine autonomy, resulting in decreased self-efficacy among college students. Attachment theory helps to explain these dynamics, suggesting that insecure attachment styles fostered by helicopter parenting can hinder emotional and social development. Students may struggle to form healthy peer relationships and manage stress effectively. Furthermore, studies demonstrate that helicopter parenting correlates with lower academic motivation and performance, as students become reliant on parental guidance rather than developing independent problem-solving skills. Mental health outcomes are also affected, with evidence linking helicopter parenting to increased anxiety, depression, and stress among college students.

• Relationship Between Single Parenting Attributes and Academic Performance of Higher Secondary Students in Ranchi

Keerti Singh, Ankit Halder

The relationship between single parenting and academic performance among higher secondary students has been widely studied, revealing both challenges and potential strengths. Research shows that students from single-parent households often face disadvantages such as reduced financial resources, time constraints, and emotional stress, which can negatively affect academic performance. Parental involvement remains a key factor—while single parents may have limited time, those who stay actively engaged in their children's education can mitigate many of these challenges. Socioeconomic status

plays a crucial role, as lower-income single-parent families may lack access to educational resources, further impacting academic outcomes.

- **Pathways Among Family Socioeconomic Status, Parenting Stress, Home Learning Environment, and Toddlers' Early Academic Skills**

Miao Zhong, Kit Ling Yeung, Melissa Pearl Caldwell, Sum Kwing Cheung

This literature explores how family socioeconomic status (SES), parenting stress, and home learning environments impact toddlers' early academic skills. SES directly influences access to educational resources, while parenting stress can negatively affect the home learning environment. Research shows that high-SES families often provide enriching environments that foster early academic skills, while families with lower SES may struggle with resources, which can increase stress levels. Parenting stress, in turn, affects the quality of parent-child interactions, which is crucial for early learning. The home learning environment—encompassing books, educational toys, and engaged parent-child activities—is essential for toddlers' cognitive and language development. In conclusion, socioeconomic factors, stress, and the quality of the home learning environment all significantly contribute to toddlers' early academic skills development.

- **The Impact of Parenting Styles and Socio-Economic Status on Adolescents' Academic Performance, Emotional, and Behavioral Outcomes: A Cross-Sectional Study**

Pandey Mangesh, Krishna Dwivedi, Behera Narayan

Research on the impact of parenting styles and socioeconomic status (SES) on adolescents' academic performance, emotional, and behavioral outcomes reveals significant associations. Authoritative parenting, characterized by warmth and structured discipline, is consistently linked to positive academic outcomes and emotional well-being. Adolescents from authoritative homes tend to exhibit higher motivation, self-esteem, and academic achievement. Conversely, authoritarian and permissive parenting styles are often associated with poorer academic performance and increased behavioral issues. SES also plays a crucial role: adolescents from higher SES backgrounds typically have access to better educational resources, which boosts academic success, emotional regulation, and behavioral health. In contrast, adolescents from lower SES backgrounds may face challenges like limited access to educational support, leading to academic underachievement, emotional stress, and behavioral difficulties. Studies suggest an interaction between parenting styles and SES, where high SES can buffer the negative effects of less effective parenting styles, while low SES exacerbates them. This highlights the importance of a supportive home environment and adequate resources for adolescents' holistic development.

- **Association of Preschool Children's Behavior and Emotional Problems with the Parenting Behavior of Both Parents**

Su-Mei Wang, Shuang-Qin Yan, Fang-Fang Xie, Zhi-Ling Cai

The association between parenting behavior and the emotional and behavioral problems of preschool children has received significant attention in developmental psychology. Research indicates that parenting styles—authoritative, authoritarian, permissive, and neglectful—can profoundly influence children's emotional regulation, social competence,

and behavioral outcomes. Studies suggest that warm, responsive parenting is linked to lower instances of behavioral issues and emotional problems in children, while harsh or inconsistent parenting can exacerbate anxiety, aggression, and other emotional difficulties. Moreover, the involvement of both parents in a child's upbringing plays a crucial role in shaping behavioral outcomes. Dual-parent households often provide a broader emotional support network, which contributes to healthier child development. Conversely, parental conflict and discord can negatively impact children's emotional well-being. Interventions that target parenting practices have shown promise in mitigating behavioral and emotional problems in children, underscoring the need for supportive resources for parents. Overall, understanding the interplay between parenting behaviors and children's emotional and behavioral health is vital for developing effective strategies to promote positive outcomes in early childhood development.

Methodology

1. Data Collection

- The dataset was collected from a survey targeting students, gathering information on academic performance, family background, study habits, and emotional well-being.

2. Data Cleaning

- **Handling Missing Values:** Identify and handle missing or null values, if any.
- **Data Type Conversion:** Convert relevant columns to appropriate data types (e.g., converting age to integer, percentage scores to float).
- **Removing Duplicates:** Check for duplicate entries and remove them.
- **Standardizing Column Names:** Clean column names for uniformity and easier analysis (e.g., removing spaces, special characters, and converting to lowercase).
- **Data Imputation:** For any missing or ambiguous data points, consider using median/mode imputation.

3. Exploratory Data Analysis (EDA)

- **Descriptive Statistics:** Compute summary statistics such as mean, median, standard deviation, and range for numerical variables.
- **Univariate Analysis:** Analyze individual variables using histograms, box plots, and frequency counts (for categorical data).
- **Bivariate Analysis:** Explore relationships between variables using scatter plots, bar plots, and correlation matrices.
- **Correlation Analysis:** Identify and quantify relationships between numeric features using correlation coefficients.
- **Outlier Detection:** Detect and handle outliers using box plots and z-scores.

4. Statistical Testing

- **Hypothesis Testing:** Perform statistical tests (e.g., t-tests, ANOVA) to determine significant differences or relationships between variables.
- **Chi-Square Test:** Analyze relationships between categorical variables.

5. Feature Engineering

- **Encoding Categorical Variables:** Use label encoding or one-hot encoding for categorical variables.
- **Creating New Features:** Derive new features based on existing data, such as `Total_study_time` and `Income_per_family_member`.

6. Model Building

- **Model Selection:** Choose appropriate machine learning models based on the analysis objectives (e.g., Linear Regression, Decision Tree).
- **Train-Test Split:** Split the data into training and testing sets (e.g., 80%-20% split).
- **Model Evaluation:** Use evaluation metrics like R-squared, Mean Absolute Error (MAE), and accuracy.

7. Assumption Checks for Regression

- **Multicollinearity:** Use VIF (Variance Inflation Factor) to check multicollinearity among predictors.
- **Homoscedasticity:** Verify constant variance of residuals.
- **Normality of Residuals:** Use Q-Q plots and the Shapiro-Wilk test to check residual normality.

8. Visualization

- Utilize Power BI or Python libraries (Matplotlib, Seaborn) to create visualizations such as:
 - Distribution plots for Percentage across different Gender.
 - Bar charts for Highest_education levels vs. average Percentage.
 - Heatmaps for correlations between numerical variables.

9. Discussion and Analysis

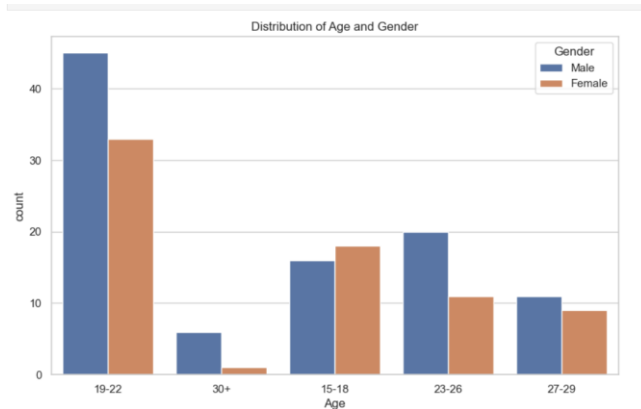
- Interpret findings from EDA, statistical tests, and model outputs.
- Discuss insights, highlighting any significant factors affecting academic performance, emotional challenges, and family background.

10. Conclusion

- Summarize key findings and provide recommendations based on the analysis.
- Suggest potential areas for future research or improvements in data collection methods.

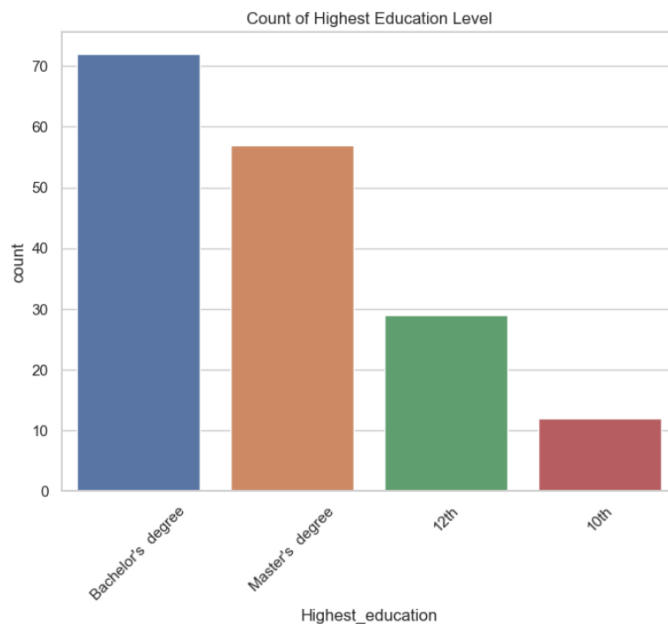
• Exploratory Data Analysis (EDA):

1. Distribution of Age and Gender.



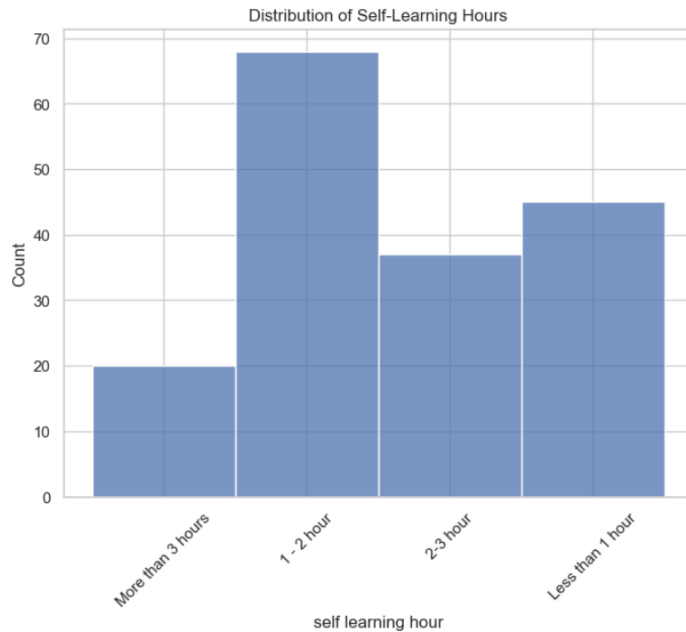
The chart show the distribution of Age and Gender wise. The count of response of age 19-22 is maximum where male and female is collected more in from this age group. The study is based on different age response. The above diagram show the count of reponse.

2. Count of Highest Level of education



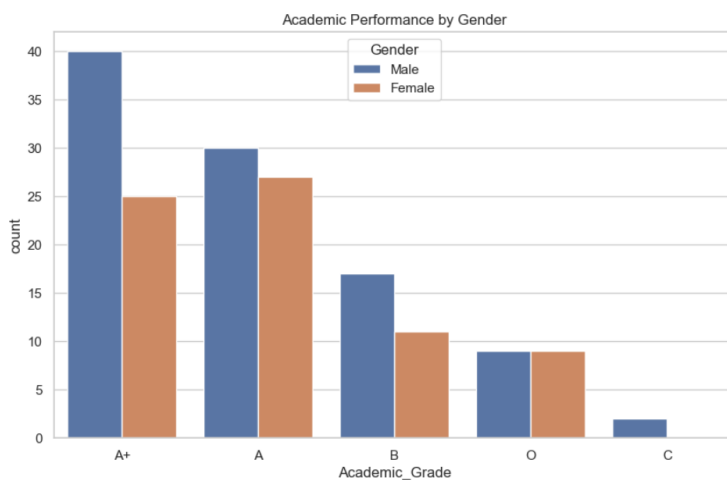
The Above diagram show the count of highest level of education is observed. For above we have Bachelor degree highest response count and after that master degree and then 12th and 10th level count.

3. Distribution of self-Learning Hours



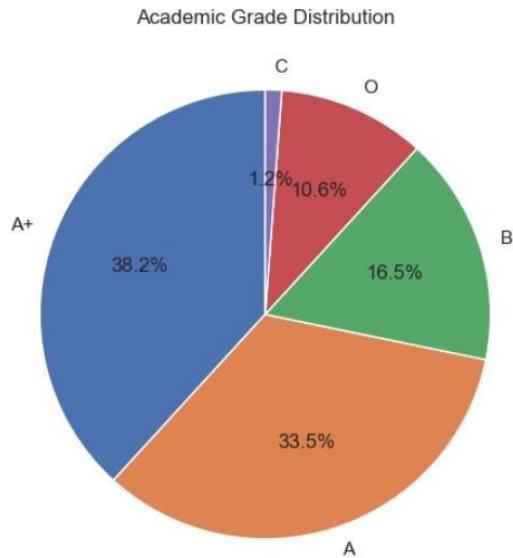
Above graph show the distrubtion of study hours where 1-2hours responces count is more and where as the second count which is more is of students studying less than 1 hours too.

4.Academic Performance by Gender



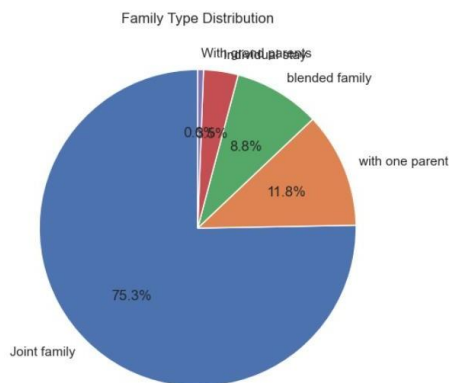
Above diagram show the total count of students and highest count of grade achieved by students in academic performance as per Genderwise.The above diagram show count of A+ grade students is maximum for and girls.

5. Academic Grade Distribution



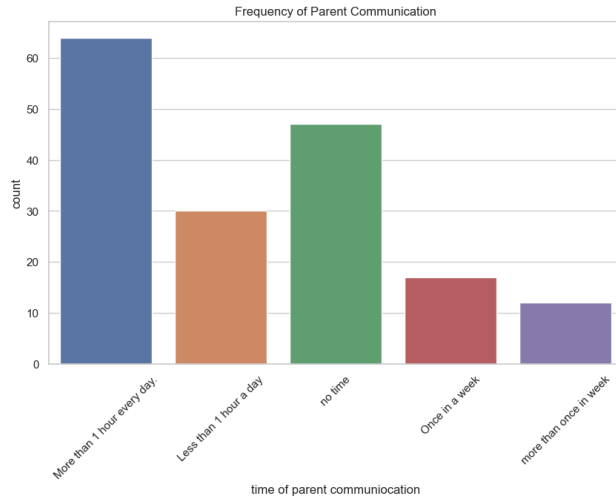
Above diagram the total count of percentage as per academic grade as distribution in pie chart.

6. Family Type Distribution



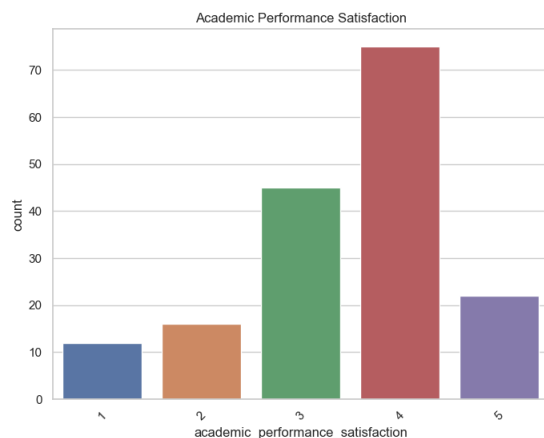
The above chart show distribution for above family structure. The joint family count is more in number. A significant majority, **75.3%**, belong to **joint families**, indicating a strong presence of extended family living arrangements. **11.8%** are **single-parent families**, while **8.8%** are in **blended families** (families with step-parents or step-siblings). A smaller percentage, **3.5%**, live with **grandparents**, and a very small portion, **0.6%**, fall under **other family types**. This distribution suggests that joint families are the predominant family structure in the surveyed group.

7. Frequency of Parents communication.



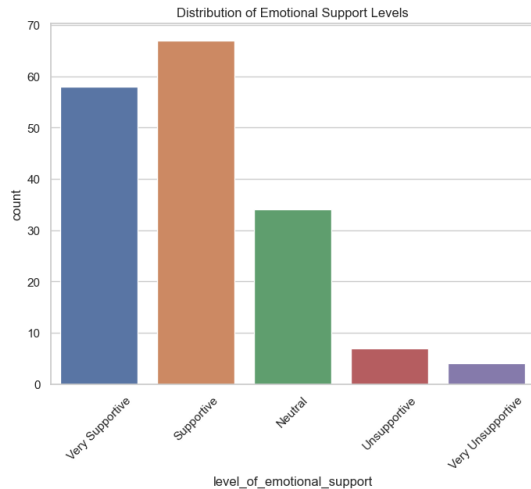
The chart shows the distribution of time spent by parents with students for doing school-related activities (e.g., studying, reading or helping them). More than 1 hour every day counts. Most parents either spend time daily (over an hour) or not at all, creating a contrasting dynamic. This trend could imply that families are either very engaged or face challenges that limit interaction. The frequency of parent communication and or time spent by them could have implications for children's emotional and academic development, with daily engagement likely being beneficial.

8. Academic Satisfaction of Parents towards students performance.



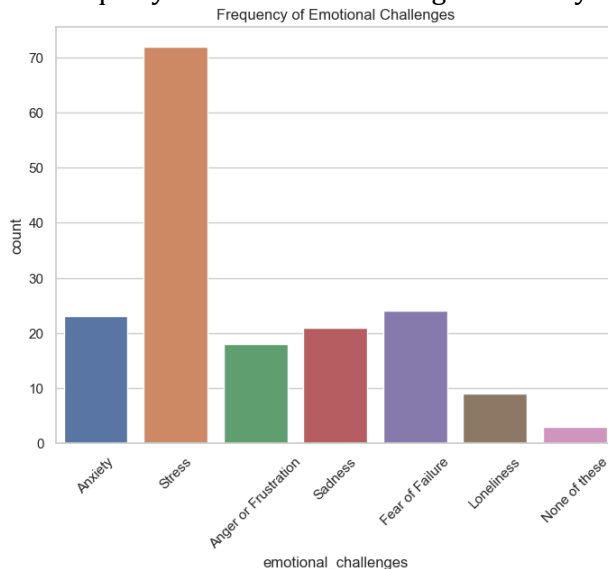
The chart illustrates the levels of satisfaction with academic performance on a scale from 1 to 5. Most respondents are at a satisfaction level of 4, with a count over 70, indicating high satisfaction with their academic performance. The next largest group is at level 3 (moderate satisfaction), with around 40 respondents. Satisfaction levels 1, 2, and 5 have fewer responses, suggesting that extreme levels of dissatisfaction and full satisfaction are less common. Overall, the data shows that a majority are content with their academic performance, with only a few at the lower or highest ends of the scale.

9. Distribution of Emotional supports by parents towards academic performance.



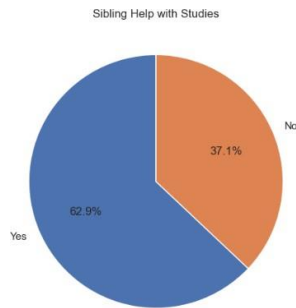
The above chart shows that most respondents feel highly supported emotionally, with "Supportive" and "Very Supportive" being the most common responses. A moderate number feel neutral, while very few report feeling unsupported. This suggests a generally positive perception of emotional support among respondents.

10. Frequency of Emotional Challenges faced by students during studying



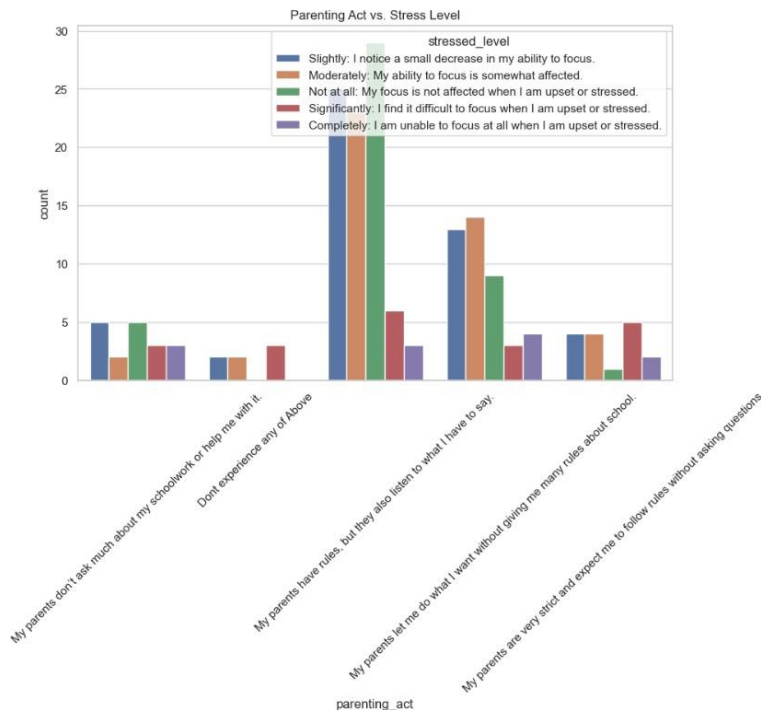
The above chart shows the frequency of various emotional challenges faced by students that make it hard for you to focus on your academic tasks or studying. "Stress" is the most commonly reported challenge, significantly higher than other emotions. "Fear of Failure," "Anxiety," and "Sadness" also appear frequently, while "Loneliness" and "None of these" are reported by the fewest respondents. This suggests that stress is a prominent concern, followed by a range of other emotional challenges at lower frequencies.

11. Siblings help



The above diagram show the distribution of siblings in the studies.

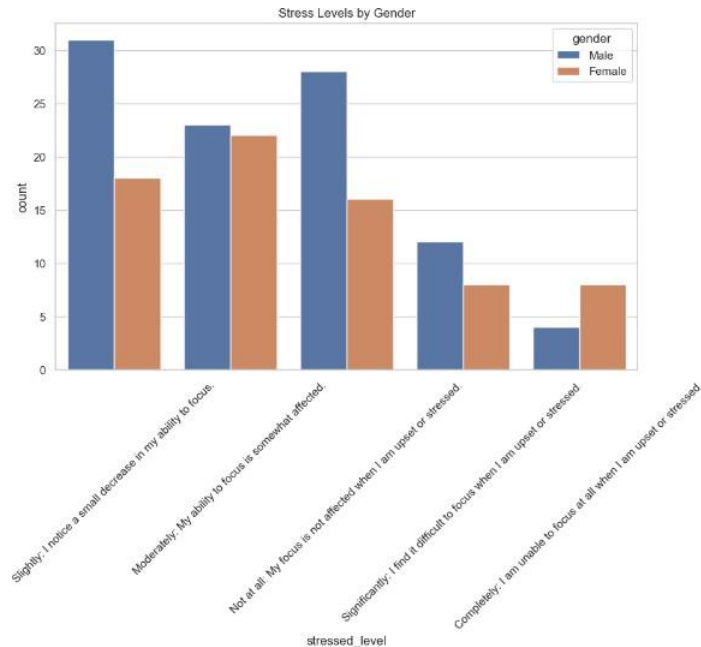
12. Parenting Act Vs Stress level



This graph explores the relationship between parenting styles and stress levels affecting children's ability to focus. The highest counts fall under the balanced parenting style, where "parents have rules but also listen," showing a lower impact of stress on focus. This suggests that supportive and communicative parenting is associated with better focus during stress. In contrast, more permissive or very strict parenting styles are linked to higher levels of focus disruption, especially under moderate to high stress. Children whose parents don't show much interest in their schoolwork or (enforce strict rules without allowing the child to discuss or ask questions tend to have more difficulty concentrating or staying focused, especially when they are feeling stressed.

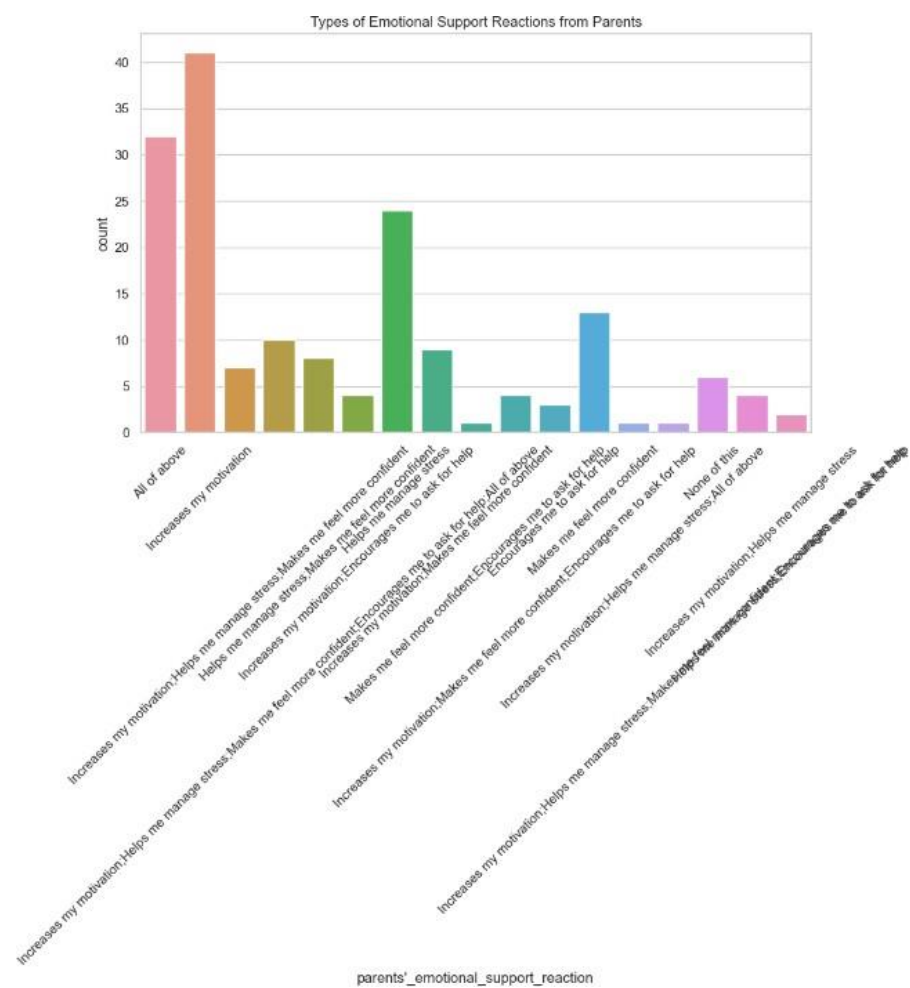
The parenting style that combines structure (rules) with support and open communication (listening to the child's perspective) seems to make it easier for children to cope with stress.

13. Stress Level Vs Gender



The graph shows that males generally report lower levels of focus disruption due to stress, with higher counts in the "Slightly" and "Not at all" categories. Females, however, experience more focus disruption at moderate to significant stress levels. At the extreme end ("Completely"), males have a slightly higher count. This suggests that stress impacts focus differently by gender, with females experiencing a steadier increase in focus issues as stress levels rise.

14. Emotional Support Reaction of parents



Data Analysis:

1. Decision Tree Model

The **Decision Tree** model achieved an accuracy of **43.1%**. Let's interpret each part of the classification report.

Classification Report for Decision Tree:

- **Class 0:**
 - **Precision:** 46%, meaning that of all instances predicted as class 0, only 46% were correct.
 - **Recall:** 30%, indicating that the model correctly identified 30% of the true instances for class 0.
 - **F1-score:** 36%, reflecting a balance between precision and recall.
- **Class 1:**
 - **Precision:** 47%, which shows moderate accuracy when the model predicted class 1.
 - **Recall:** 44%, meaning the model identified 44% of true class 1 instances.
 - **F1-score:** 46%, suggesting the model performs slightly better for class 1 than for class 0.
- **Class 2:**
 - **Precision:** 42%, which is moderate but not particularly high.
 - **Recall:** 56%, showing a better ability to capture true positives for class 2 compared to other classes.
 - **F1-score:** 48%, showing a somewhat better fit for this class.
- **Class 3:** No support for class 3 was correctly predicted, leading to zero values across precision, recall, and F1-score. This indicates that the model failed to predict any true instances of this class.
- **Class 4:**
 - **Precision:** 38%, which is the lowest among all classes, indicating fewer correct predictions when identifying class 4.
 - **Recall:** 75%, meaning the model was more successful in identifying true positives of class 4.
 - **F1-score:** 50%, suggesting that while recall is high, the model lacks precision for this class.

Overall Model Performance:

- The **macro average F1-score** is **0.36**, indicating poor performance across all classes without accounting for class imbalance.

- The **weighted average F1-score** is **0.43**, which averages the F1-scores across classes, adjusting for class frequencies.

The low accuracy and F1-scores suggest that the **Decision Tree** is struggling to capture complex relationships in the data, potentially due to **overfitting** or **insufficient depth** in capturing feature interactions.

2. Random Forest Model

The **Random Forest** model achieved a higher accuracy of **49%** and generally performed better across metrics compared to the Decision Tree model.

Classification Report for Random Forest:

- **Class 0:**
 - **Precision:** 47%, showing moderate accuracy in predicting class 0.
 - **Recall:** 45%, which is higher than in the Decision Tree model and indicates better detection of true class 0 cases.
 - **F1-score:** 46%, a balanced metric slightly improved from the Decision Tree.
- **Class 1:**
 - **Precision:** 48%, similar to the Decision Tree.
 - **Recall:** 67%, showing a stronger performance in identifying true instances of class 1.
 - **F1-score:** 56%, higher than in the Decision Tree, reflecting improved prediction power.
- **Class 2:**
 - **Precision:** 50%, a slight improvement over the Decision Tree.
 - **Recall:** 33%, which is lower than the Decision Tree but may be due to a trade-off in the model's focus.
 - **F1-score:** 40%, indicating fair performance.
- **Class 4:**
 - **Precision:** 100%, suggesting that all instances predicted as class 4 were correct.
 - **Recall:** 25%, meaning only 25% of true class 4 instances were identified.
 - **F1-score:** 40%, indicating that while it's precise, the model is missing many instances of class 4.

Overall Model Performance:

- The **macro average F1-score** is **0.45**, reflecting the model's improved overall performance.
- The **weighted average F1-score** is **0.48**, showing that the model is capturing slightly better predictions across different classes.

Conclusion: The **Random Forest** model performs better than the Decision Tree model, with higher accuracy and F1-scores for most classes. This improvement suggests that

Random Forest's ensemble approach benefits from reduced overfitting and improved generalization.

1. Hyperparameter Tuning

```
In [38]: # increase accuracy

In [39]: from sklearn.model_selection import GridSearchCV

# Define the parameter grid for Random Forest
param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [10, 20, 30, None],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['auto', 'sqrt', 'log2']
}

# Initialize Grid Search
grid_search = GridSearchCV(estimator=RandomForestClassifier(random_state=42),
                           param_grid=param_grid,
                           cv=5, n_jobs=-1, verbose=2, scoring='accuracy')

# Fit Grid Search
grid_search.fit(X_train, y_train)
best_rf_model = grid_search.best_estimator_

# Evaluate the tuned model
y_pred_best_rf = best_rf_model.predict(X_test)
print("Tuned Random Forest Accuracy:", accuracy_score(y_test, y_pred_best_rf))
print("Best Parameters:", grid_search.best_params_)
```

Fitting 5 folds for each of 324 candidates, totalling 1620 fits

Activate

3. Feature Importance Analysis in Random Forest

In Random Forest models, feature importance indicates how much each feature contributes to making accurate predictions. Below is an interpretation of key features related to **parenting** and how they might impact the model's accuracy.

Top Features:

- **percentage** (12.89%): This feature, possibly representing academic performance or completion percentage, plays the most significant role. It suggests that student academic achievement is highly predictive of the outcome related to parenting.
- **family_members** (5.65%): This variable's influence may reflect how family dynamics (e.g., sibling count) impact a child's educational environment and parental support.
- **parents'_emotional_support_reaction** (4.99%): This feature directly captures parental emotional support, a core aspect of parenting. Its high importance underscores how parents' responses significantly influence academic or emotional outcomes.
- **time_of_parent_communication** (4.44%): This feature may reflect the frequency or timing of communication between parents and children, indicating its importance in supporting academic or personal issues.

- **study_resources** (4.34%): Access to resources for study is essential, as it might signal parental involvement in providing tools for academic success.

Interpretation of Key Features Related to Parenting:

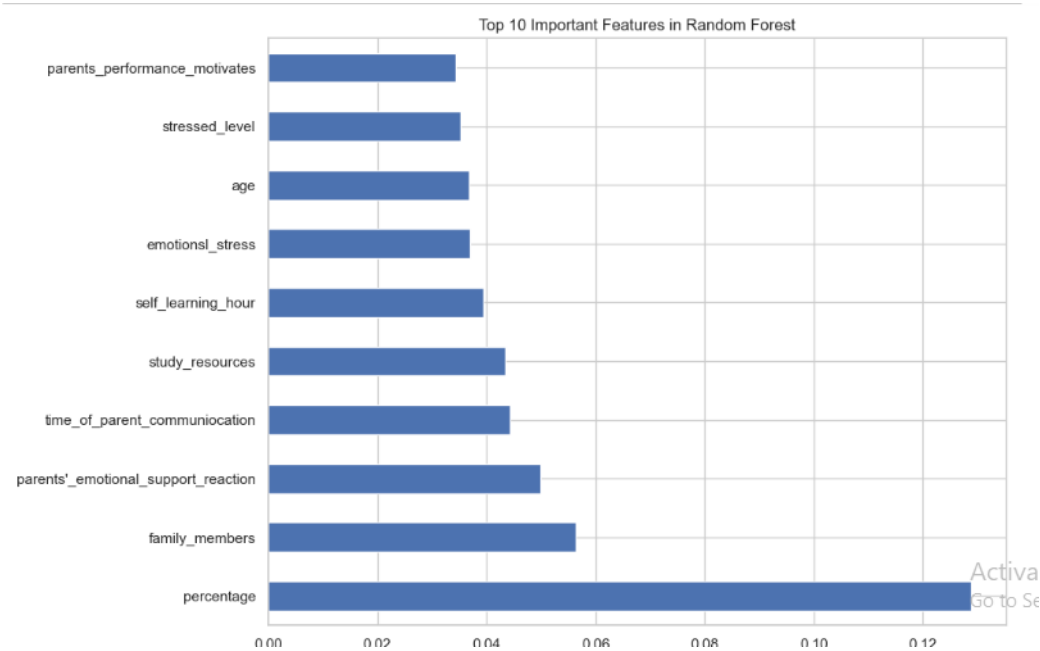
- **Emotional and Academic Support:** Features like *parents'_emotional_support_reaction*, *positive feedback to parents on academic result*, and *parents'_performance motivates* all highlight how parental responses to academic and personal achievements play a critical role in shaping the child's educational environment.
- **Home Environment:** Variables such as *home_distracted_by_noise* and *secure_family_environment* provide insights into the stability and support provided within the home, which is a crucial factor in the child's concentration and motivation.
- **Parent-Child Communication:** *Time_of_parent_communication* and *level_of_emotional_support* reflect the emotional and practical support structure established by parents, influencing the child's ability to manage stress and academic responsibilities.

Conclusion: The feature importance analysis emphasizes that **parenting behaviors**, **home environment**, and **supportive actions** (like communication and academic resources) are integral in predicting outcomes related to academic performance and emotional well-being. This understanding can help refine models and focus on the most impactful parenting features, potentially improving predictive accuracy in future models.

In summary:

- **Random Forest** outperformed **Decision Tree**, suggesting that the ensemble model is better suited for this dataset.
- **Feature importance** underscores that aspects of parenting, such as support and home environment, are crucial in predicting the target variable.
- **Model improvements** could include focusing on key features identified here, fine-tuning model parameters, or using additional data preprocessing steps.

Feature Selection Random Forest:



Summary of the Feature Importance Graph:

The **feature importance** graph highlights that **academic performance indicators (like percentage)**, **family environment**, and **emotional and academic support from parents** are critical factors in the model's predictions. This suggests that **parental involvement**, both emotionally and through providing resources, significantly impacts the child's academic and emotional outcomes.

In future modeling efforts, focusing on these top features may help improve accuracy, and these insights can also guide interventions aimed at improving student well-being and academic success through enhanced parental support.

ANOVA AND CHI-SQUARE TEST :

1. Pearson Correlation Analysis

Objective: To determine the relationship between **emotional stress** and **academic grade**.

Code Explanation:

- The code converts the columns `emotionsl_stress` and `academic_grade` to numeric types for analysis.
- It then calculates the **Pearson correlation coefficient** and **p-value** between these two variables using the `pearson()` function.
- **Pearson Correlation Coefficient** measures the strength and direction of a linear relationship between two numeric variables.
- **P-value** tests the null hypothesis that there is no linear relationship between the variables.

Hypotheses:

- **Null Hypothesis (H0):** There is no significant correlation between emotional stress and academic grade (Correlation coefficient = 0).
- **Alternative Hypothesis (H1):** There is a significant correlation between emotional stress and academic grade (Correlation coefficient \neq 0).

Results:

- **Correlation Coefficient:** -0.16
- **P-value:** 0.0374

Conclusion:

- The correlation coefficient is **-0.16**, indicating a weak negative relationship between emotional stress and academic grade.
- The **p-value** is **0.0374**, which is less than the significance level of 0.05, suggesting that this relationship is statistically significant.
- **Interpretation:** Higher emotional stress is associated with lower academic grades, but the effect size is small.

2. ANOVA Analysis

Objective: To test if the number of siblings affects the academic performance (academic grade).

Code Explanation:

- The code converts the `sibling` column to numeric.
- It groups the data by the number of siblings and performs an **ANOVA test** to compare the means of academic grades across different sibling groups.
- **ANOVA (Analysis of Variance)** tests whether there are statistically significant differences between the means of three or more independent groups.

Hypotheses:

- **Null Hypothesis (H0):** The number of siblings does not have a significant effect on academic grade (Mean grades are equal across sibling groups).
- **Alternative Hypothesis (H1):** The number of siblings has a significant effect on academic grade (Mean grades differ across sibling groups).

Results:

- **F-statistic:** 1.10
- **P-value:** 0.3624

Conclusion:

- The **F-statistic** is **1.10**, and the **p-value** is **0.3624**, which is greater than the significance level of 0.05.
- **Interpretation:** The result is not statistically significant, indicating that there is no evidence to suggest that the number of siblings affects academic performance in this dataset.

3. Chi-Square Test: Effect of Parental Expectation on Academic Performance

Objective:

To determine if there is an association between **parental expectation of academic performance** and the actual **academic grade** of students.

Code Explanation:

- The code performs a **Chi-Square test** of independence between two categorical variables: `parent_expect_academic_performance` (parental expectations) and `academic_grade` (students' academic performance).

- **Crosstab** is used to create a contingency table showing the frequency distribution of parental expectations against academic grades.
- The **Chi-Square test** checks if the observed frequencies differ from the expected frequencies under the assumption of independence.

Hypotheses:

- **Null Hypothesis (H0):** There is no association between parental expectations and academic grades (they are independent).
- **Alternative Hypothesis (H1):** There is an association between parental expectations and academic grades (they are dependent).

Results:

- **Chi2 (Chi-Square Statistic):** 26.75
- **P-value:** 0.0443

Conclusion:

- The **Chi-Square statistic** is **26.75**, and the **p-value** is **0.0443**.
- Since the p-value is less than 0.05, we reject the null hypothesis.
- **Interpretation:** There is a statistically significant association between parental expectations and students' academic grades. This suggests that higher parental expectations may be related to better academic performance, although this test does not establish causation.

4. ANOVA: Emotional Stress vs. Academic Satisfaction

Objective:

To assess if students' **satisfaction with their academic performance** affects their **emotional stress** levels.

Code Explanation:

- The `academic_performance_satisfaction` is converted to numeric, assuming it's an ordinal variable representing satisfaction levels.
- An **ANOVA test** is conducted to evaluate whether there are significant differences in **emotional stress** across different levels of academic satisfaction.
- The ANOVA test compares the means of emotional stress for different levels of satisfaction to see if they differ significantly.

Hypotheses:

- **Null Hypothesis (H0):** Academic satisfaction does not affect emotional stress (means of emotional stress are equal across satisfaction levels).

- **Alternative Hypothesis (H1):** Academic satisfaction affects emotional stress (means of emotional stress differ across satisfaction levels).

Results:

- **F-statistic:** 2.65
- **P-value:** 0.0353

Conclusion:

- The **F-statistic** is **2.65**, and the **p-value** is **0.0353**.
- Since the p-value is less than 0.05, we reject the null hypothesis.
- **Interpretation:** The test indicates that there is a statistically significant difference in emotional stress levels based on academic satisfaction. Lower satisfaction with academic performance is likely associated with higher emotional stress, highlighting a potential impact of unmet academic expectations on students' emotional well-being.

Hypothesis Testing and Interpretation

Test 1: ANOVA for Home Noise Distraction on Academic Grades

- **Objective:** To test if **home noise distraction** has a significant effect on **academic performance**.
- **Null Hypothesis (H0):** There is no significant effect of home noise distraction on academic grades.
- **Alternative Hypothesis (H1):** There is a significant effect of home noise distraction on academic grades.
- **Result:**
 - **F-value:** 0.42
 - **p-value:** 0.7945
- **Interpretation:** Since the p-value (0.7945) is much higher than the typical significance level (0.05), we fail to reject the null hypothesis. This indicates that **home noise distraction does not have a significant effect on academic grades** in this dataset.

Test 2: ANOVA for Secure Family Environment on Emotional Stress

- **Objective:** To test if having a **secure family environment** affects **emotional stress** levels.
- **Null Hypothesis (H0):** There is no significant effect of a secure family environment on emotional stress.
- **Alternative Hypothesis (H1):** There is a significant effect of a secure family environment on emotional stress.

- **Result:**
 - **F-value:** 5.93
 - **p-value:** 0.0002
- **Interpretation:** The p-value (0.0002) is less than 0.05, so we reject the null hypothesis. This suggests that **a secure family environment has a significant impact on emotional stress** levels. This result implies that a more secure family environment may be associated with lower emotional stress in children.

Test 3: Chi-Square Test for Parenting Act vs. Academic Satisfaction

- **Objective:** To test if there is an association between **parenting act** (certain parenting behaviors or actions) and **academic performance satisfaction**.
- **Null Hypothesis (H0):** There is no association between the parenting act and academic performance satisfaction.
- **Alternative Hypothesis (H1):** There is an association between the parenting act and academic performance satisfaction.
- **Result:**
 - **Chi-Square value (χ^2):** 6.21
 - **p-value:** 0.0457
- **Interpretation:** The p-value (0.0457) is close to the threshold of 0.05, suggesting a borderline significant association. We can cautiously reject the null hypothesis, implying that **there is an association between parenting act and academic performance satisfaction**. This means that certain parenting behaviors may influence how satisfied children feel about their academic performance.

SENTIMENT ANALYSIS:

```
In [11]: # Import necessary Libraries
from textblob import TextBlob
import numpy as np

# Select columns for sentiment analysis
text_columns = ['stressed_level', 'emotional challenges', 'level of emotional support', "parents' emotional support reaction"]

# Preprocess and analyze sentiment
sentiment_results = {}

for col in text_columns:
    # Drop nulls, lowercase and apply TextBlob
    data[col] = data[col].astype(str).str.lower()
    data[f'{col}_sentiment'] = data[col].apply(lambda x: TextBlob(x).sentiment.polarity)

    # Categorize sentiment scores into positive, neutral, negative
    data[f'{col}_sentiment_label'] = data[f'{col}_sentiment'].apply(
        lambda x: 'positive' if x > 0 else ('negative' if x < 0 else 'neutral')
    )

    # Save sentiment distribution for each column
    sentiment_results[col] = data[f'{col}_sentiment_label'].value_counts()

# Display sentiment analysis results for each column
sentiment_results

Out[11]: {'stressed_level': neutral    89
          negative    81
          Name: stressed_level_sentiment_label, dtype: int64,
          'emotional challenges': neutral    128
          negative    42
          Name: emotional challenges_sentiment_label, dtype: int64,
          'level of emotional support': positive    129
          neutral    41
          Name: level of emotional support_sentiment_label, dtype: int64,
          "parents' emotional support reaction": neutral    117
          positive    53
          Name: parents' emotional support reaction sentiment label, dtype: int64}
```

1. Stressed Level

- **Sentiment Counts:**
 - **Neutral:** 89
 - **Negative:** 81
- **Interpretation:**
 - The sentiment for the **stressed level** is almost evenly split between **neutral** (89 instances) and **negative** (81 instances), with no **positive** sentiment recorded.
 - This indicates that most individuals in the dataset either experience a moderate level of stress or a clear negative (or high) level of stress. Since there is no positive sentiment, this suggests that stress is predominantly viewed in a negative light or as something to be managed.
 - The close distribution between neutral and negative sentiments implies that while some individuals may be handling stress adequately, a significant portion is likely struggling with it, pointing towards a need for stress management support.

2. Emotional Challenges

- **Sentiment Counts:**
 - **Neutral:** 128
 - **Negative:** 42
- **Interpretation:**
 - The majority of sentiments for **emotional challenges** are **neutral** (128 instances), with fewer instances marked as **negative** (42 instances) and none as positive.
 - This suggests that while emotional challenges are present, they are perceived as manageable or moderate for most individuals, hence the neutral sentiment. Only a smaller portion of individuals find emotional challenges to be significantly negative, which might indicate cases where emotional challenges are causing notable distress.
 - The predominance of neutral sentiment could imply that emotional challenges are a common but not overwhelmingly negative experience for most people, potentially seen as part of normal life.

3. Level of Emotional Support

- **Sentiment Counts:**
 - **Positive:** 129
 - **Neutral:** 41
- **Interpretation:**
 - For the **level of emotional support**, the majority of responses are **positive** (129 instances), with some **neutral** responses (41 instances) and no negative responses.
 - This indicates that most individuals feel positively about the level of emotional support they receive, suggesting that there is strong or sufficient emotional support present in the environment.
 - The positive sentiment suggests that emotional support may be a protective factor that could help individuals cope with stress and emotional challenges. The presence of some neutral responses might indicate variability in the consistency or quality of support, but generally, it is viewed as adequate or beneficial.

4. Parents' Emotional Support Reaction

- **Sentiment Counts:**
 - **Neutral:** 117
 - **Positive:** 53
- **Interpretation:**
 - In the case of **parents' emotional support reaction**, most responses are **neutral** (117 instances), with a smaller proportion being **positive** (53 instances) and no negative responses.
 - This suggests that while parental emotional support is generally perceived as satisfactory (neutral), there are also instances where it is viewed positively, indicating that some parents provide a strong level of support that is well-received.

- The absence of negative sentiment implies that, overall, parental emotional support is not viewed negatively, but the relatively high neutral count might mean that some individuals receive support that feels more functional or moderate rather than exceptionally positive.

Overall Interpretation

This sentiment analysis provides insights into the emotional environment experienced by individuals, particularly in relation to stress, emotional challenges, and the level of support they receive:

1. Stress and Emotional Challenges:

- There is a notable presence of negative sentiment for stress, indicating a group of individuals who may be struggling to manage it effectively.
- Emotional challenges are largely viewed neutrally, meaning they are present but generally perceived as manageable by most individuals.

2. Support Systems:

- The **level of emotional support** is overwhelmingly positive, which is a good sign as it suggests that individuals have access to a supportive environment.
- **Parents' emotional support reaction** is largely neutral, with a portion viewing it positively, indicating that while parental support is generally present, it may vary in intensity or quality.

3. Key Insights:

- There is a clear **need for stress management** strategies, as many individuals experience stress negatively.
- Positive **emotional support** is a strong protective factor, potentially helping individuals cope with stress and emotional challenges.
- The **role of parents** in providing emotional support is mixed, with some children benefiting greatly while others receive only moderate levels of support. This may highlight areas where parents could enhance the quality of support to improve emotional outcomes for their children.

In conclusion, while individuals generally feel supported emotionally, there is room to improve parental involvement and address the sources of stress. Strengthening support systems and providing stress management resources could enhance overall well-being and academic satisfaction for the individuals in this dataset.

Conclusion

Summarize the research objectives, methods, and main findings. Highlight key takeaways and practical applications.

Based on the detailed analysis and findings of the research, here are the top 10 conclusions:

1. **Parenting Style Impact:** Authoritative parenting, which balances support with structure, is most positively associated with students' emotional well-being and academic performance. Authoritarian and neglectful styles tend to result in poorer academic and emotional outcomes.
2. **Socioeconomic Status (SES):** Higher SES correlates with access to better educational resources, fostering better academic and behavioral outcomes. Lower SES often imposes constraints that can limit academic achievement and increase parenting stress.
3. **Parental Involvement and Communication:** Regular parental involvement, particularly in academic-related activities, positively influences students' motivation and focus. Parents who spend daily time with their children on school-related tasks contribute significantly to better academic performance.
4. **Parental Emotional Support:** Emotional support from parents is crucial in helping students manage stress. Students who perceive their parents as supportive are more likely to achieve higher academic satisfaction and experience lower levels of stress.
5. **Academic Expectations and Performance:** High parental expectations are positively associated with students' academic achievements, suggesting that when parents set high but achievable standards, students are more motivated to meet them.
6. **Single Parenting Challenges:** Students from single-parent families face unique challenges, often due to limited resources or time constraints, impacting academic performance. However, active parental engagement can help mitigate some of these effects.
7. **Home Environment:** A stable home environment, free from excessive noise and distractions, supports students' concentration and study habits. Secure family dynamics are linked to lower emotional stress in students.
8. **Gender Differences in Stress Response:** Females tend to report higher levels of stress that interfere with academic focus, whereas males generally report lower stress-related disruption. This suggests a need for targeted support strategies to address these differences.

9. Supportive Sibling Influence: Sibling support positively affects students' academic resilience, particularly when both parental support and siblings' involvement are present.

10. Emotional Challenges: Stress is the most commonly reported emotional challenge impacting academic focus, followed by fear of failure and anxiety. Effective stress management and emotional support are essential to mitigate these issues.

These conclusions provide valuable insights for parents, educators, and policymakers to understand and support students' academic and emotional needs.

Here is the future scope and challenges related to the findings in the research document:

Future Scope

1. Enhanced Parenting Programs: Developing educational programs for parents can help them adopt more effective parenting styles, such as the authoritative approach, to improve their children's academic and emotional outcomes. Such programs could target both general parenting skills and specific areas like emotional support and academic involvement.

2. Focus on Socioeconomic Interventions: Research could explore targeted interventions for families of lower socioeconomic status, providing access to educational resources and reducing parenting stress. Future studies might evaluate the impact of financial assistance, community resources, or parental education programs on students' performance.

3. Technology-Driven Support Systems: There is potential for integrating technology into parenting support, such as mobile applications that guide and track parental involvement, emotional support, and academic engagement with children. Such tools could be especially useful for busy or single parents.

4. Gender-Specific Interventions: Future research can explore tailored approaches to address gender-specific emotional challenges. For instance, programs could target coping strategies for female students who experience higher stress levels, while also considering distinct needs for male students.

5. Exploration of Sibling and Peer Influence: While parental influence is significant, future studies could investigate the role of siblings and peers in shaping students' academic motivation and emotional well-being. This can offer insights into extended family dynamics or friend groups as support networks.

6. Cross-Cultural Studies on Parenting Styles: Further research across diverse cultural contexts could reveal how parenting practices impact academic and emotional outcomes worldwide. Understanding cultural nuances could inform tailored approaches that respect

and integrate different family structures and values. 7. Impact of Mental Health Programs: Introducing mental health resources directly within educational institutions could help students manage stress and emotional challenges more effectively. Studies might evaluate the long-term academic benefits of integrating counseling or resilience-building programs in schools.

Challenges

1. Varied Family Dynamics: Given the diversity of family structures (single-parent, joint, nuclear, blended), implementing a one-size-fits-all approach is challenging. Each family type might require customized support strategies, which can complicate program design and scalability.

2. Economic and Time Constraints: Lower-income families and single parents often lack time and resources for consistent involvement in their children's education. Addressing these disparities while ensuring equitable support poses a significant challenge.

3. Cultural Differences in Parenting Perceptions: Cultural beliefs deeply influence parenting practices, which means that certain interventions or recommended styles (like authoritative parenting) may not be universally accepted. Sensitivity to cultural norms is essential when implementing parenting programs or interventions.

4. Balancing Technology and Personal Interaction: Although technology can facilitate parenting support, over-reliance on digital tools might undermine meaningful parent-child interactions. Designing tech-driven interventions that enhance, rather than replace, real-time involvement is a key challenge.

5. Mental Health Stigma: Despite its importance, mental health support remains stigmatized in many communities. Encouraging parents and students to seek help can be difficult in such environments, potentially limiting the effectiveness of stress management interventions.

6. Measuring Long-Term Impact: Tracking the long-term effects of parental involvement and emotional support is complex, especially with evolving family dynamics and changing educational pressures. Longitudinal studies are needed, but they require significant time and resources.

7. School-Parent Collaboration: Effective student support often requires strong collaboration between schools and families, but achieving this alignment can be challenging. Schools may struggle to communicate effectively with families, and some parents might lack the time or resources to engage fully.

8. Adapting to Adolescent Independence: As students grow older, they often seek independence, which can reduce the impact of parental involvement. Creating age-

appropriate strategies that respect adolescents' autonomy while providing needed support is a delicate balance.

Future research and program designs must address these challenges to support holistic student development effectively.

References

List all references in the chosen citation style (e.g., APA, MLA). Include all sources cited in the research.

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