Nanotechnology Perceptions
ISSN 1660-6795
www.nano-ntp.com

The Impact of Parental Education on Student Academic Performance

P. Aparna[1], K. Snigdha[2], A. Akhileshwar[2], A. Vishal[2], S. Meghana[2]

[1]Department of Mathematics, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, India.
[2]Student, Department of CSE-(CYS, DS) and AI &DS, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, India.
Email: aparnapodila@gmail.com

In this present research, the study examines the influence of parental education on student academic performance. Parents play an important role in shaping their children's destinies, and one way they do it is through education. If parents held bachelor's or associate's degrees, kids were more likely to score in the high range, suggesting a connection between parental education and academic success.A one-way ANOVA, linear regression analysis, and Chi-Square test are among the statistical methods used to investigate the relationship between student academic achievement and parental education levels.The results of the linear regression analysis demonstrate that parents' educational attainment has a statistically significant effect on the academic achievement of their offspring. Generally speaking, children of more educated parents have better average scores. Still, that's not all! Other variables including gender, race/ethnicity, and socioeconomic position are also examined in this study. Together with parental education levels, they factors influence academic results. Additionally, the study explores the potential benefits and drawbacks of test prep classes and school meal programs in closing educational disparities. Thus, a lot is happening in relation to this significant issue!
Findings: Therefore, by applying Chi Square and Anova analysis, the study found out that parental education played a very significant role on student's performance. Special attention is paid to the levels of parental education, whereas students having parents with the bachelor or associate degree were reported to have a higher proportion of "High" academic performance. Investigating the estimate results of the linear regression model, there was a statistical significant negative effect whilst comparing the outcome variable average scores to the level of "high school" and "some high school" of parents. However, the overall explained variance in student performance was quite negligible 4.654% thus the presence of other factors.
Novelty: The paper provides an extensive analysis of parental education level and students' performance, and various demographic characteristics and statistical methods.

Keywords: Parental education, Student academic performance, Statistical analysis, Hypothesis testing, Educational interventions.

1. Introduction

Education is said to be the light that makes not only people but also societies to be formed. And therefore, let us not forget that the cornerstone of any child's learning process is his/her parents. The study also showed a positive relationship between parents' knowledge and

perception of education and the child's attitude toward learning and academic performance of the child. Research has demonstrated that where both parents have gone to school for more years, according to their children's performance in school. It makes sense, right? Theses parents realise how much education is valued, and they do their best to ensure that the children appreciate this fact. They build a home, a home where education is cherished, home where children can excel and home where dreams of a better future are fondue.

However, it's not the same for each and every family out there in the communities. It is not fun also for parents who attended school for a short time and this makes things difficult for their kids. He or she may not get as much assistance with assignments or he or she may not think that he or she can push school as far as he or she can. It's a very difficult position to be in when one feels that they have started off from a wrong position Resolving the matters Relating to Understanding the Interconnections between Students' Performance and Teachers' Expectations was the topic focused by [1]. Amponsah et al. [2] were discussed Peer effects in education: what is their potential impact, the scale of it, and what has been known about them so far? Priya Katyara et al. [3] were discussed how Technology Affects Students' Engagement Along Four Aspects: These four are Cognitive, Behavioral, Reflective and Social learning theories. Kjell Morten Stormark et. al [4] were discussed, The relationship between sleep issues and elementary school students' academic achievement: Studies based on findings from a population-based prospective study carried out in Norway. This study conducted in the Ashanti Mampong Municipality of Ghana was focused to analysing students' academic performance and parents' engagement in their children's learning process and was conducted by [5]. Employing Structural Equation Modeling on the relationship between Parents, Academic Engagement, Academic Level of Education on ELL Students' Self-Regulation and Academic Achievement was conducted by [6]. In relation to the identification of the principal in framing and supporting participation from both home and school, this was as stated by.[7]

Chen [8], his study focuses on parental, teacher and peer support and adolescent academic achievement in Hong Kong. It also aims at examining the moderating effect of Academic Engagement on this association. Student perception of how much their parents are involved which was measured by Wei-Bing Chen and Anna Gregory was analysed to understand whether the perceived level of parental participation by students can predict improvement in academic, mental,(results), and relationship outcomes for low-achieving adolescents[9]. Crosby et. A study by al [10] examines the effectiveness and sustainability of a school based parent engagement program which was implemented by school staff without input from outside experts for consecutive three years in a public school. Dove et. Nagi, Seo and Valderrama [11], in their research work, researched on the relationship between Parental Participation Practices, and the reading gain scores of former Head Start children. The original theory for Dove is the Academic and Demographic Model of Parental Involvement which was formulated by Motherway, Barron and O'Connell in 1999. al [12].

Parental Involvement and Mexican American Youth Academic Achievement: What forms of participation really count? This paper aims to use Obatin entry Arrow analyzed by [13] as a basis in order to develop the main ideas in this paper. Review cooperation programs: Several considerations that deserve to be taken into account. Editors: School, families and communities: A guide for taking action by J. L. Epstein Partnerships between Schools, Families and Communities was made by [14].

The main subject of this research topic is the relationship that exists between parents' educational achievements and their children's performance in school. We will look at the grades of 1000 students in the US and then attempt to find out whether the level of education of parents impacts on the performance of the children. From it, we are also able to determine how best to make certain that all students in a given class be given a chance to perform well despite their parents' education background.Factors affecting student academic achievement in Mathematics, Reading, and Writing: A case of StudentPerformance. csv dataset. Find out the relationship of parental education level to student performance in mathematics, reading, and writing while controlling for gender, race/ethnicity and socioeconomic status.

What is the impact or correlation of participation in the lunch program (standard or the free/reduced price) on the academic progress of students? To what extent does the effects of taking exam preparation courses translate to improvements in the writing and reading and mathematics strands? It would also employ statistical analysis to examine how gender, race/ethnicity, parental education, and SES collectively impact on the students' performance.

1.1 Problem Statement and Formulation of the problem

1.1.1. Problem Statement

Thus, the American educational system is colorful and diverse, the paths of which students choose are predetermined by many factors, and parental involvement is one of them. This can be expected since parents' education has always been seen as an important factor for students' success in high school but its relationship has not been fully explained.

This study is all about diving deep into some big questions:This study is all about diving deep into some big questions:

1. Does it really matter what type of education the student's parents had? The two questions are: Are there differences in school performance of kids whose parents went to college as compared to those whose parents didn't go to college?

2. Is there such preparation for high achievements only for student whose parents are also students, or, in other words, are students with highly educated parents really more successful than students with low educated parents; or all students have an equal opportunity to show themselves?

3. What role does parents education level play in children's motivation towards academic performance, method of studying and performance in general?

What we actually aim to find out when we really push ourselves with these two questions is quite a lot about students' experience in high school nationwide based on parents' education. From this, it will be easier to formulate proper ways of helping children and ensure that each and every person gets an equal shot at life.

1.1.2. Formulation of the problem

The dataset we have is like a treasure trove of information about students: their gender, race, what their parents do, and even how they do in school. But what does it all mean for how well they're learning?

1.1.3. Parental Level of Education and Academic Performance:

Parents play a big role in shaping their kids' futures, and one way they do that is through education. We want to see if parents who went to school for longer tend to have kids who do better in school. It's like connecting the dots between parents' degrees and their kids' grades in math, reading, and writing.

1.1.4. Test Preparation Course and Academic Performance:

Taking a test prep course might seem like a good idea, but does it really help students perform better? We want to see if students who take these courses end up with higher scores in math, reading, and writing.

Finally, we're not just looking at these factors on their own. We want to see how they all fit together. Does a student's race impact how much their parents' education counts? Are there other things we might have missed? By piecing these clues, we really want to find out what helps every student do well in school, no matter where they came from.

2. Methodology

The relation between parental education levels and student academic performance was examined using statistical techniques such as the Chi Square test, One way Anova, and linear-regression analysis. The information came from the Kaggle "Student Performance with Parents' Education" dataset, comprising information on students' test scores, demographic details, and parental education levels. Relevant variables were selected, and categorical variables were encoded for compatibility with the statistical techniques employed

2.1 Dataset

For this study, we used a dataset from Kaggle. It's all about how parents' education affects their kids' performance in school. If you want to check it out, you can download it here: https://www.kaggle.com/code/pulkit21aug/student-performance-with-parents-education/input

Dataset provides an insight of how students performed in school. Besides, it reveals information on their parents' education level as well.

We might be able to view factors such as; age, gender, test scores and grades among others. These details make it easier to comprehend the relations between effectiveness of parents' education & their children's performance. Through this data and therefore applying stats as part of this research work, we would like to discover more on how parents' education affect children's learning.

2.2 Summary Function

But firstly, let us view some highlighted summary findings for a while. In the field of information research this idea may be one of the most effective tools to apply. In plain English, it tells an analyst what is a must- know when getting to grips with a basic of a given dataset. Short overviews provide a look at topics that are crucial to understanding the field, including central tendency, changeability, and information delivery. The following are some typical

outline capacities that you may find suitable:The following are some typical outline capacities that you may find suitable:

Mean: As you take the sum of all the value and divide by the total number of values then you get the average or the cruel. From this, you are able to establish the position of the center of your dataset.

Median: The middle value is the number which is in the middle when all of the values have been ordered according to their size. It's valuable.

Mode: The median is the middle value when the dataset values are arranged in ascending or descending order and the mode is the value that occurs most frequently. This is particularly useful with ‘ ‘catalogue like’ data.

Standard Deviation: This means it represents how much the scores differ from the mean which is the average of the given data set. According to a greater number, the diversity of the data is higher.

Range: The range is easy; it is merely the difference between the maximum and minimum values.

Interquartile Range (IQR): Through use of the IQR, it is possible to subtract the first quartile from the third one, with the result illustrating where in the distribution the middle fifty percent of the data is. The effect of such observations on it is smaller than the effect on the range.

Count: This one only gives the cumulative number of observations in the dataset with no information regarding how they were distributed or any thing.

Summary Statistics Table: This table provides a summary of the descriptive statistics of all the variables in one place and include mean, median, mode, standard deviation, range and quartiles.

These summarizing functions are incredibly important As in any other ship, they are very important in any company. They help us in explaining a dataset and guide more informed decision based on the analyzed data. They help analysts diagnose trends, patterns and anomalies!! These summary statistics will be very useful later in additional analysis and modeling, using more complex equations and formulas!

2.3 Output:

```
> summary(student_performance_data)
   gender          race.ethnicity     parental.level.of.education    lunch          test.preparation.course   math.score     reading.score
 Length:1000        Length:1000        Length:1000                 Length:1000        Length:1000            Min.   :  0.00   Min.   : 17.00
 Class :character   Class :character   Class :character            Class :character   Class :character       1st Qu.: 57.00   1st Qu.: 59.00
 Mode  :character   Mode  :character   Mode  :character            Mode  :character   Mode  :character       Median : 66.00   Median : 70.00
                                                                                                             Mean   : 66.09   Mean   : 69.17
                                                                                                             3rd Qu.: 77.00   3rd Qu.: 79.00
                                                                                                             Max.   :100.00   Max.   :100.00

 writing.score
 Min.   : 10.00
 1st Qu.: 57.75
 Median : 69.00
 Mean   : 68.05
 3rd Qu.: 79.00
 Max.   :100.00
```

2.4 Chi-Square Method

A Chi-Square (χ^2) test is a really handy tool! It helps us see if two things are connected. People often use it to match what we actually see with what we expect to see. super effective for checking out categorical data.

2.4.1 Procedure

So, let's break down how you usually do a Chi-Square test:

Set Up Your Hypotheses: First of all, you should have your first research hypothesis of the study (H1). This one says there is a difference. In contrast to the first case, the null hypothesis hypothesis (H0) assumes that there is no true relationship between the variables.

Find Expected Frequencies: Next, if you suppose that the variables don't interfere with each other, you calculate how frequently each category should appear if everything is fine according to your sample data.

Calculate the Chi-Square Statistic: You wish to add some more fun for math time now let's go! You'll use this formula to calculate your Chi-Square statistic: represented by $\Sigma \{ (O - E)^2/E = \chi^2]$.

Here's what those letters mean:

χ^2 is your Chi-Square statistic Here you can have a general look at CHI2, Chi-Square Distribution, ChiSquare at a Glance and Chi-Square / Likelihood Ratio.

O stands for what you observed In the above chart O stands for what initially observed or in simple terms what one sees initially at the physical level.

E is your expected frequency, this is the value which you are expecting or you would like the system to return you when certain inputs are made to a system.

Determine Degrees of Freedom: After that, turn to the Chi-Square distribution table to identify how many degrees of freedom (df) are available to you. This part guides you to know the critical value.

Compare to Critical Value: Select your significance level possibly like 0. 05. Then, draw a comparison test to check if the Chi-Square statistic that you computed at the above step is greater than the critical value of Chi-Square obtained from the Chi-Square distribution table.

Interpret Results: Therefore, if your calculated Chi-Square number is larger than that critical value, you can have the right to reject the null hypothesis! That means that there has to be a real relationship between the two of your variables.

Chi-squared test is greatly utilized when working with nominal data. It assists in identifying significant correlation between different factors! This makes it popular amongst researchers & analysts to give them great insights into their datasets!

2.4.2 Code:

```
getwd()
setwd("C:\\Users\\akhil\\OneDrive\\Desktop\\Research paper")
library(tidyverse) # metapackage with lots of helpful functions
library(gmodels)
library(dplyr)
## Reading in files
list.files(path = "../input")
#Load the data
student_performance_data <- read.csv("./StudentsPerformance.csv")
summary(student_performance_data)
str(student_performance_data)
#hist(student_performance_data$math.score)
#hist(student_performance_data$reading.score)
#hist(student_performance_data$writing.score)
#Derive student performance based on avg score
student_performance_data$avg_score <- (student_performance_data$math.score +
                                       student_performance_data$reading.score +
                                       student_performance_data$writing.score)/3
getPerformance <- function (avg_score) {
  result <- 'Medium'
  if(avg_score >= 80) {
    # print('High')
    result <- 'High'
  } else if (avg_score > 60 && avg_score <80) {
    result <- 'Medium'
    # print('Medium')
  } else {
    result <- 'Low'
  }
  return(result)
}
student_performance_data$ac_perf <- as.factor(mapply(getPerformance,
                                                     student_performance_data$avg_score))
CrossTable(student_performance_data$parental.level.of.education,
           student_performance_data$ac_perf ,chisq=TRUE )
```

2.5. Anova Test

Summarisation This has been argued that maternal education plays a very crucial role in the performance of a pupil in his or her studies. The test that will be used in this study to analyze the result is the Analysis of Variance (AOV) commonly referred as (ANOVA), the inferential aim of this study is to assess relationship between kiddies' performance and their parents education level. The determination of F ratio ANOVA is another statistical way of feeding the proportion of the mean of sample for each group.

2.5.1. ANOVA Test Procedure

1. Null and Indispensable suppositions: Symbolically, HO posits that there is no difference in kiddies' academic performance when the mothers are of different education level: H1 – Opposes this opinion.

2. Hypotheticals Verification : It was on the premise that compliance of one group is not tied with the other groups compliance They believed that the compliances of the two groups are unrelated.

A set of figures that should display normal distribution is the data in each order of Maternal education. • In the Unity of Variances Group, there must always be variances/dis-aversions of almost equal magnitude.

3.F- Statistic computation: F-ratio is computed by Anova representing rate of variation within the groups when compared to the friction between the groups. A higher reliability coefficient is proved together with tangible differences in the average values if such variability, the binnen groups is considerably less than the variability of the friction between them.

4. Interpretation of Results: The null thesis is rejected if the p-value for the F-statistic is less than the named threshold to purport that there is difference in the academic performance of the subjects under different maternal education situation at the significance level (predominantly 0. 05). This makes ANOVA a great tool in determining the impact of certain categorical independent variables such as the maternal education situations in matters of non-stop dependent variables which include the performance. Faculty with the understanding of the principles and hypothetical situations becomes more observant of the factors that influence issues of education and makes philosophical decision on how to nurture pupils.

2.5.2. Code:

```
# Set the working directory
setwd("C:/Users/akhil/OneDrive/Desktop/Research paper")
# Load required libraries
library(tidyverse)
library(gmodels)
# Read the data
student_performance_data <- read.csv("StudentsPerformance.csv")

# Define a function to categorize average scores
getPerformance <- function(avg_score) {
  if(avg_score >= 80) {
    return('High')
  } else if (avg_score >= 60 && avg_score < 80) {  # Modified condition to include scores of 80
    return('Medium')
  } else {
    return('Low')
  }
}
# Check for any NA values in avg_score column
if (anyNA(student_performance_data$avg_score)) {
  stop("There are NA values in the avg_score column. Please handle them before proceeding.")
}

# Create a new column for student performance category
#student_performance_data$ac_perf <- as.factor(mapply(getPerformance,
#student_performance_data$avg_score))
# Calculate average score
student_performance_data$avg_score <- (student_performance_data$math.score +
                                       student_performance_data$reading.score +
                                       student_performance_data$writing.score) / 3

# Perform one-way ANOVA test to analyze the association between parental education
#and average score
anova_result <- aov(avg_score ~ parental.level.of.education, data = student_performance_data)
summary(anova_result)
```

2.6 Linear Regression

Direct relapse investigation could be a factual strategy that makes a difference us get it the

association between one or more indicator factors & a nonstop result variable. For occasion, it can appear how parents' instruction levels affect how well kids perform in school.

2.6.1. Model Evaluation

1. R-squared (R^2): This number tells us how much of the changes in subordinate variable are clarified by the autonomous ones.

2. Adjusted R-squared: Think of this as R-squared's more astute kin! It adjusts for the number of indicators within the show, giving us a clearer thought of how well it fits.

3. To check the by and large importance of the relapse show, devices just like the p-value & F-statistic come into play.

The comes about from the direct relapse investigation give important experiences approximately how children's victory in school interfaces to their parents' instruction levels. By looking at the model's coefficients & seeing what's noteworthy, policymakers & teachers can make educated choices to bolster understudies and near those instructive holes. Additionally, there's continuously room for more research— like checking out other components that might influence scholarly execution and figuring out on the off chance that endeavors to make strides decency in instruction are truly working!

2.6.2 Code:

```
# Set the working directory
setwd("C:/Users/akhil/OneDrive/Desktop/Research paper")

# Load required libraries
library(tidyverse)

# Read the data
student_performance_data <- read.csv("StudentsPerformance.csv")

# Calculate average score
student_performance_data$avg_score <- (student_performance_data$math.score +
                                       student_performance_data$reading.score +
                                       student_performance_data$writing.score) / 3

# Fit a linear regression model
lm_model <- lm(avg_score ~ parental.level.of.education,
               data = student_performance_data)

# Summary of the regression model
summary(lm_model)
```

3. Results and Discussions:

3.1.1. Chi - Square Test Results

```
> str(stu_perf_data)
'data.frame':   1000 obs. of  10 variables:
 $ gender                     : chr  "female" "female" "female" "male" ...
 $ race.ethnicity             : chr  "group B" "group C" "group B" "group A" ...
 $ parental.level.of.education: chr  "bachelor's degree" "some college" "master's degree" "associate's degree" ...
 $ lunch                      : chr  "standard" "standard" "standard" "free/reduced" ...
 $ test.preparation.course    : chr  "none" "completed" "none" "none" ...
 $ math.score                 : int  72 69 90 47 76 71 88 40 64 38 ...
 $ reading.score              : int  72 90 95 57 78 83 95 43 64 60 ...
 $ writing.score              : int  74 88 93 44 75 78 92 39 67 50 ...
 $ avg_score                  : num  72.7 82.3 92.7 49.3 76.3 ...
 $ ac_perf                    : Factor w/ 3 levels "High","Low","Medium": 3 1 1 2 3 3 1 2 3 2 ...
```

3.1.2. Chi square test output:

Stu_perf_data$ac_perf <- as.factor(mapply(getPerformance, Stu_perf_data$avg_score))

> CrossTable(Stu_perf_data$parental.level.of.education, Stu_perf_data$ac_perf ,chisq=TRUE)

```
   Cell Contents
|-------------------------|
|                       N |
| Chi-square contribution |
|           N / Row Total |
|           N / Col Total |
|         N / Table Total |
|-------------------------|

Total Observations in Table:  1000
```

student_performance_data$parental.level.of.education	student_performance_data$ac_perf High	Low	Medium	Row Total
associate's degree	51	59	112	222
	1.129	0.562	0.009	
	0.230	0.266	0.505	0.222
	0.258	0.201	0.220	
	0.051	0.059	0.112	
bachelor's degree	31	21	66	118
	2.496	5.329	0.587	
	0.263	0.178	0.559	0.118
	0.157	0.072	0.130	
	0.031	0.021	0.066	
high school	20	79	97	196
	9.115	8.103	0.077	
	0.102	0.403	0.495	0.196
	0.101	0.270	0.191	
	0.020	0.079	0.097	
master's degree	20	10	29	59
	5.923	3.072	0.035	
	0.339	0.169	0.492	0.059
	0.101	0.034	0.057	
	0.020	0.010	0.029	
some college	46	58	122	226
	0.035	1.020	0.422	
	0.204	0.257	0.540	0.226
	0.232	0.198	0.240	
	0.046	0.058	0.122	
some college	46	58	122	226
	0.035	1.020	0.422	
	0.204	0.257	0.540	0.226
	0.232	0.198	0.240	
	0.046	0.058	0.122	
some high school	30	66	83	179
	0.836	3.502	0.722	
	0.168	0.369	0.464	0.179
	0.152	0.225	0.163	
	0.030	0.066	0.083	
Column Total	198	293	509	1000
	0.198	0.293	0.509	

```
Statistics for All Table Factors

Pearson's Chi-squared test
------------------------------------------------------------
Chi^2 =  42.97301     d.f. =  10     p =  5.028598e-06
```

3.2 Anova Test Results:

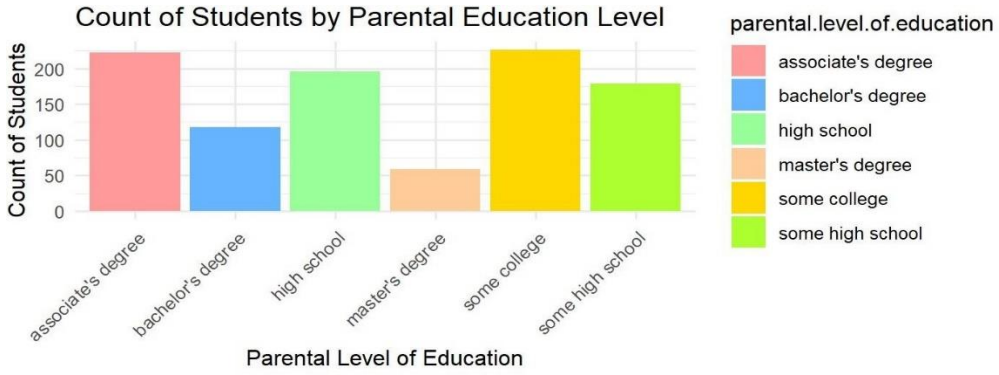
```
> summary(anova_result)
                              Df Sum Sq Mean Sq F value   Pr(>F)
parental.level.of.education    5  10420  2084.1   10.75 4.38e-10 ***
Residuals                    994 192648   193.8
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

3.3 Linear Regression Results:

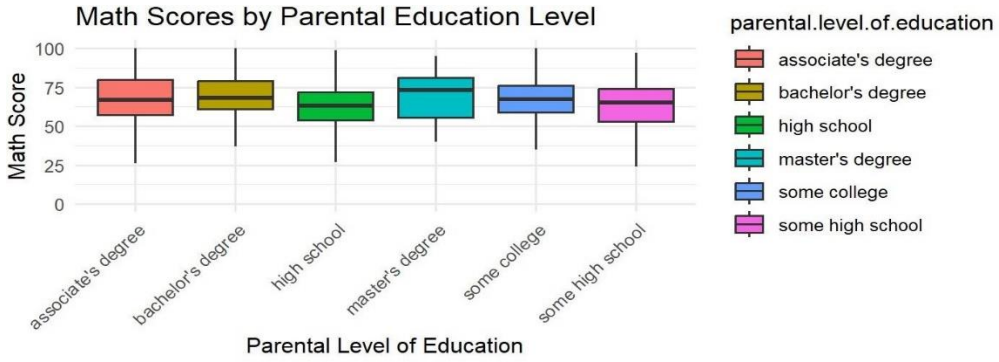
```
Call:
lm(formula = avg_score ~ parental.level.of.education, data = student_performance_data)

Residuals:
     Min       1Q   Median       3Q      Max
-56.108   -9.259    0.874    9.895   33.892

Coefficients:
                                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                                  69.5691     0.9344  74.457  < 2e-16 ***
parental.level.of.educationbachelor's degree  2.3547     1.5860   1.485  0.13796
parental.level.of.educationhigh school       -6.4721     1.3645  -4.743 2.41e-06 ***
parental.level.of.educationmaster's degree    4.0298     2.0391   1.976  0.04840 *
parental.level.of.educationsome college      -1.0927     1.3155  -0.831  0.40640
parental.level.of.educationsome high school  -4.4611     1.3985  -3.190  0.00147 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 13.92 on 994 degrees of freedom
Multiple R-squared:  0.05131,   Adjusted R-squared:  0.04654
F-statistic: 10.75 on 5 and 994 DF,  p-value: 4.381e-10
```

3.4. Plots :

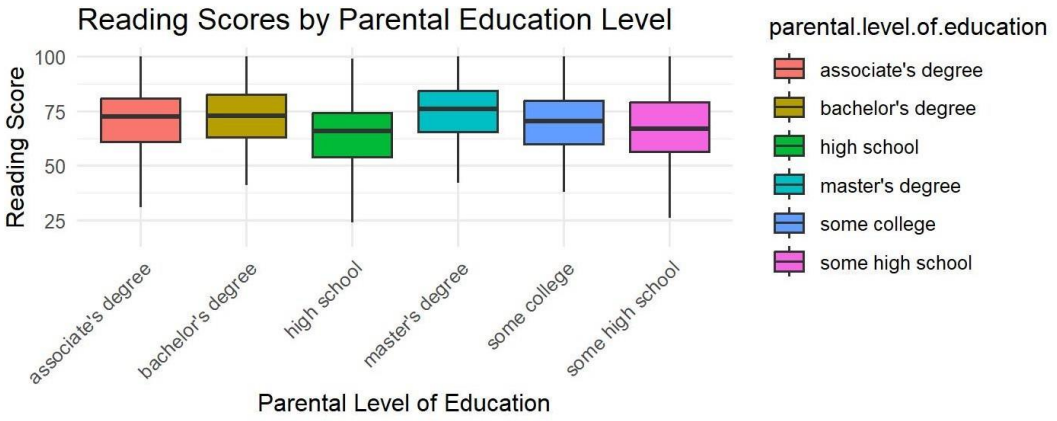
Plot 1:



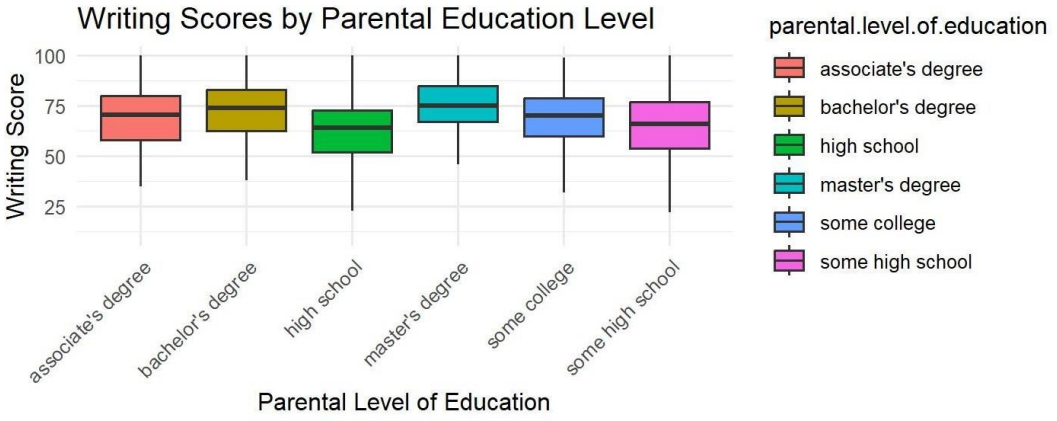
Plot 2:



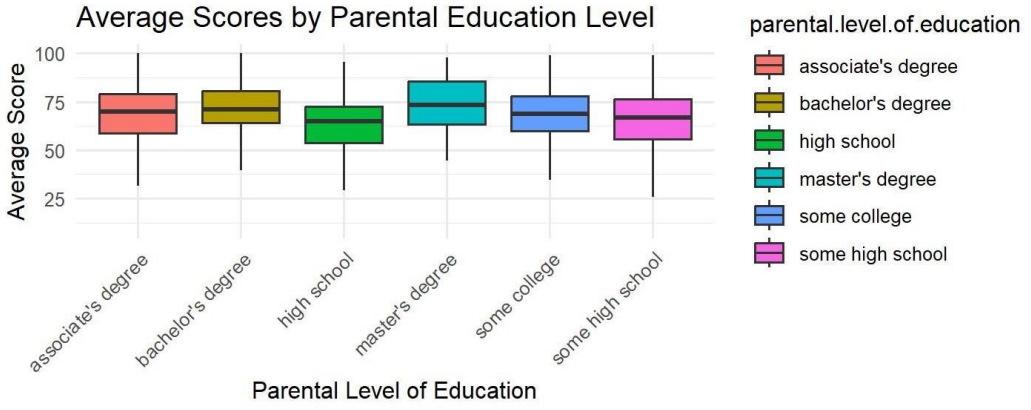
Plot 3:



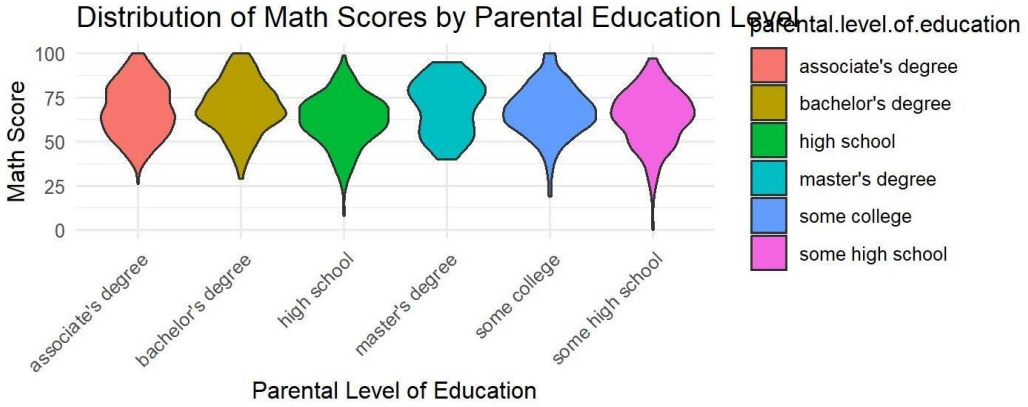
Plot 4:



Plot 5:



Plot 6:



3.5. Chi-Square Test Conclusion:

From the information we have, we can see a few important things:From the information we have, we can see a few important things:

1. Chi-Squared Test Result: When 10 degrees of freedom existed we determined that the chi-squared test statistic was equal to 42. 97301. Whoa! The p-value is beyond negligible – in fact, it is around 5 hold your horses it is extremely small. 028598e-06. This tells us that there is a positive correlation between level of education of parents and the performance of students in school.

2. Cell Contents Table: It indicates the observed frequency in respective cell. However, it has some pretty nice features such as chi-square contributions along proportionalities resulting from the row totals and the column totals.

3. Total Observations: The data set has a total of 1000 observation! It is a lot to look at!

4. Cell Contents Analysis: To elaborate what specific frequencies are included in each cell, it is possible to describe the differences in the students' performance depending on the parents' education level. Isn't that interesting? For instance, more students with parents who have a bachelor's degree or associate degree perform in the "High" performance compared to those parents with high school diploma or some high school education.

5. Conclusion: Therefore, from the frequencies of the observed data and the obtained and significant chisquare value, one can be led to conclude that student academic achievement and parental education level are positively correlated. Students whose parents have more education are likely to succeed academically than the students whose parents have little education.

In general, the research makes a point of the importance of parental support and involvement by pointing out that parental education has a critical role to play in children's academic performance.

3.6 Analysis of variance or ANOVA

Analysis of variance or ANOVA is a statistical test used to compare more than two groups of data Measurement of central tendency such as the means of different populations or samples

is done using

Analysis of variance For the one-way ANOVA test, it allows In connection to the above research questions: Interpretation of one-way analysis of variance is important since With this type of design, it is possible Interpreting results of a one-way analysis of variance isFrom the one-way ANOVA test it is evident that there is a relationship between the parental level of education and average student score. Here's a breakdown of the results:

Here's a breakdown of the results:

Degrees of Freedom (Df): The author has used 5 Df for the variable- The parent level of education, which means that the variable has 6 groups, or level of education being used for comparison.There are 994 Df for residuals.

Sum of Squares (Sum Sq):Sum of Squares (Sum Sq):The sum of squares for parental level of education is 10420, this is the total variation in average scores that is accounted for by parental level education factor. The Sum Sq for the residuals implies the difference in the scores which is not predictable; the value is 192648.

Mean Square (Mean Sq):This is calculated by dividing the Sum Sq by the Df as shown below; Regarding the parental level of education, F statistic is 2084 which is the mean square value. 1 as the standardised measure of between group variability is the average difference between group means.

For the residuals the value of mean square is 193. 8 was obtained, and /or n, which reflects the average variation within each group.

F Value: Indicator F has an F value of 10. 75, which means being used as the test statistic in the ANOVA test

. It determines if there are differences of average scores in children in different levels of parental education. Pr(>F): Fitting the extracted data to the null hypothesis model gives ample information for rejecting the null hypothesis for a relationship between the dependent variable, the student's academic achievement, and the

independent variable, parental education level with a highly negligible value of the p value 4.38×10^-10.

3.7. Linear-Regression Conclusions:

The linear regression model fitted to the data reveals several findings:The linear regression model fitted to the data reveals several findings:

Intercept: In the presented model intercept term equals 69. 5691. This is to mean the average score whereby the parental level of education is set at the reference level which in this case is "associate's degree."

Coefficients: The coefficients for every level characterise the change in the parameter under comparison to the reference level that is "associate's degree." For instance, students who parents have a Bachelor's degree will perform an average of about 2 better than the estimated value. of 3547 points higher than those with parents holding an associate's degree, however, the difference, (p = 0. 13796) is not statistically significant at the conventional level.

Adjusted R-squared: The model has generally got less than 5% of the total variation where the required variation should have been ideally 50%. 834% of the variability in the average students' outcomes with reference to the adjusted R-squared of 0. 04654. This proves that only a small proportion of the variance in learners' performance can be attributed to the parents' education level.

F-statistic and p-value: The F-statistic for the model is 10 and this is the overall F-statistic that has been computed for the analysis. 75 with a very small p-value which was 0.004. 381e-10This means that, there is statistical significance at every level of the model. in an effort to ascertain average number of marks given by students in relation to parental level of education.

As from the results of the linear regression analysis, it is suggested that the parental education level as one of the factors is significantly correlated with the rate of kid's academic performance with more educated parents providing students with better average results. Thus, let it be emphasized that the model attempts to explain only half of the difference in performance between students, and amplifying the outstanding idea, it might be certain that certain extra variables that are not included in the model can be fairly influential.

4. Conclusion

As evident from the results provided by the chi-square test, one-way ANOVA and regression analysis it is clear that parental education has a profound impact on the students' performance. The applying of chi-square test indicates a strong correlation between the level of education that parents acquired and the performance of the students; it means that students whose parents are more educated perform better in their class work. This is further confirmed by the result of the one way ANOVA test which shows there is significant difference in the mean student scores by different levels of parents' education and thus the null hypothesis is rejected.

Of all the approaches used, analysis of variance and covariance was most effective in capturing the variation of students' performance by their parents' education level. From the ANOVA test, we see that F-value majorly meets the significance level of 0.05 while the p-value is almost equal to zero, which clearly indicates that students' academic achievements are significantly associated with the Parental Education, as in previous findings, it plays a major determinant role in determining the students' outcome. However, the adjusted Rsquared of the linear regression model of 0.166 indicates that while parental education plays an influential role in the performance of students, it does not explain all the variation in the performance thus implying that there are other significant factors that influence performance.

Therefore, the study conclusively confirms parental education as a significant determinant of academic achievement, but admits that other factors, over and above the proposed measure include socio-economic status, quality of school and motivation among others. The identified positive and negative aspects call for the integrated approaches to education that target all of these complex factors and integrate them into the improvement of the students' performance.

References

1. Jussim L, Madon S, Chatman C. Teacher Expectations and Student Achievement, Applications of Heuristics and Biases to Social Issues, 1994;3,303-334. Available From:

https://doi.org/10.1007/9781- 4757-9238-6_16

2. Ahmad Al-Saai, Aisha Al-Kaabi, Sarah Al-Muftah. Effect of a Blended e-Learning Environment on Students' Achievement and Attitudes toward Using E-Learning in Teaching and Learning at the University Level, International Journal for Research in Education, 2011,;29,34-55, Available From: https://doi.org/10.1016/B978-0-444-53429-3.00004-1
3. Priya Katyara , Dr. Khadim Hussain Dahri , Dr. Ghullam Muhiuddin, Dr. Shabroz. Impact Of Technology On Student's Engagement In Different Dimensions: Cognitive, Behavioral, Reflective And Social Engagement; Webology, 2022, 19(3), 3451-3463, Available From: https://www.researchgate.net/publication/373102909_Impact_Of_Technology_On_Student's_Engage ment_In_Different_Dimensions_Cognitive_Behavioral_Reflective_And_Social_Engagement
4. Kjell Morten Stormark , Hedvik Elisabeth Fosse, Ståle Pallesen , Mari Hysing.The association between sleep problems and academic performance in primary school-aged children: Findings from a Norwegian longitudinal population-based study,2019,14(11), Available From: DOI: 10.1371/journal.pone.0224139
5. Amponsah, M., Milledzi, E., Ampofo, E. and Gyambrah, M. ,Relationship between parental involvement and academic performance of senior high school students: the case of ashanti mampong municipality of Ghana; American Journal of Educational Research,2018,6,1-8, Available From: https://doi.org/ 10.12691/education-6-1-1
6. Azad, M and Rashvand Semiyari, S. Effects of parents' education and academic involvement on ESP learners' selfregulation and language achievement: a structural equation modelling analysis, Research in English Language Pedagogy, 2019, 8 (1), 43-70, Available From: https://doi.org/10.30486/RELP.2019.669077
7. Barr J and Saltmarsh S. It all comes down to the leadership" the role of the school principal in fostering parent-school engagement, Educational Management Administration & Leadership, 2014, 42 (4), 491-505, Available From: https://doi.org/10.1177/1741143213502189
8. Chen J. Relation of academic support from parents, teachers, and peers to Hong Kong adolescents' academic achievement: the mediating role of academic engagement. Genetic, Social, and General Psychology Monographs, Genetic, Social, and General Psychology Monographs 2005, 131 (2), 77-127, Available From: http://dx.doi.org/10.3200/MONO.131.2.77-127
9. Chen, W-B and Gregory A. Parental involvement as a protective factor during the transition to high school. The Relationship Between Parental Involvement in Education and Academic Achievement A Meta-analysis Study Pegem Journal of Education and Instruction, ISSN 2146-0655 63 Journal of Educational Research, 103 (1), 53-62, Available From: https://doi.org/10.1080/00220670903231250
10. Crosby S, Rasinski, T, Padak N and Yıldırım, K. A 3-year study of a school-based parental involvement program in early literacy. The Journal of Educational Research,2015, 108 (2), 165-172 Available From: http://dx.doi.org/10.1080/00220671.2013.867472
11. Dove M Neuharth-Pritchett S, W. Wright D and Wallinga C. Parental involvement routines and former head start children's literacy outcomes,. Journal of Research in Childhood Education,2015, 29 (2), 173-186, Available From: http://dx.doi.org/10.1080/02568543.2015.1011360
12. Choi N, Chang M, Kim S and Reio Jr T. G, A structural model of parent involvement with demographic and academic variables. Psychology in the Schools, 2015,52 (2), 154-167, Available From: http://dx.doi.org/10.1002/pits.21813
13. Altschul, I, Parental involvement and the academic achievement of Mexican American youths: what kinds of involvement in youths' education matter most? Social Work Research,2011, 35 (3),159-170, Available From: https://doi.org/10.1093/swr/35.3.159
14. Epstein, J. L and Sheldon S B. Evaluate programs of partnership: Critical considerations. J. L. Epstein (Eds) School, family, and community partnerships: Your handbook for action,2019, 48, 323- 359. Thousand Oaks, CA:Corwin. Available From: http://dx.doi.org/10.17811/rifie.48.1.2019.31-42