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**Relationship of BS Economics Students' Internet Connectivity to Their Socio-Economic Characteristics and Academic Performance during the COVID-19 Pandemic**

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**Abstract** - The shift from face-to-face to an online modality of education due to the COVID-19 pandemic gives many challenges to students and schools. One of its challenges is poor internet connectivity during online learning. Given the said context, this study has investigated the socio-economic characteristics, internet connectivity, and academic performance of the 181 randomly selected students of the BS Economics enrolled in the Second Semester of 2021-2022. A survey instrument was conducted on the students and a speed test using the Google platform was performed by the students before and after the examinations. Descriptive statistics, chi-square test of association, and point biserial correlation were used in this study to analyze the data. The results revealed that many of the students belong to poor and low-income families. Numerous of the students have experienced slow-speed internet connection (70%) and low latency (72%) during their online learning classes. An average of four family members of the students were using the internet simultaneously. Many of them used smartphones for their online classes. However, despite the many challenges in online learning, most of the students have excellent and very satisfactory results on their summative examinations in the various periods of the semester. The socio-economic characteristics of the students have a weak association with internet connectivity in terms of the father and mother's monthly income and educational attainment. At the same time, the evidence shows that internet connectivity has no association with academic performance.

**Keywords** - Education; Academic performance; Internet connectivity, Internet speed, Online learning, Descriptive design

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### **Introduction**

The impact of the COVID-19 pandemic has changed the modality of education towards online delivery of lessons around the world. Some countries have used a mix of educational television and radio programming, and distribution of print materials (Robinson & Maitra, n.d.). In the Philippines, online platforms are the most attainable means to deliver education considering the "new normal" condition that prescribed various health protocol requirements (Tria, 2020).

Given that background, Bicol University (BU) one of the State Universities and Colleges (SUCs) in the Philippines has started its school year this August 2020 with complete online delivery of instruction. However, the study shows that there are learners who are not physically and mentally capable of engaging in online learning. The barriers are classified into technological, individual, domestic, institutional, and community. Most often encountered were struggling with adjusting learning styles, having to perform responsibilities at home, and poor communication between educators and learners (Baticulon et al., n.d.).

Study shows that online education is hindered by poor infrastructures including, network, power, inaccessibility and unavailability issues, and poor digital skills. This challenges educators and learners to adopt technology and improve their digital skills given the emerging global realities in education ("Impact of Coronavirus Pandemic on Education," 2020).

The above-mentioned difficulties encountered in the online delivery of instruction, effective acquisition of learning of the students is the central concern. The identified barriers can be considered as factors that may hinder the effective transfer of learning. One of the tools to measure learning is through summative assessment of academic performance.

Academic performance has an association with learning facilities, proper guidance, and family stress (Mushtaq et al, n.d.). Non-cognitive factors such as length of study before the break, regular supper intake, frequency of exercise,

weekend activity, and extracurricular activities affect the student's academic performance in college (Magpily & Mercado, 2015).

The existing literature provides numerous factors that affect academic performance. But in this period of the COVID-19 pandemic, the instruction is completely delivered through online modality. Hence, the students' internet connectivity can be considered one of the major constraints for the effective learning of students. This is because most of the students lack steady internet connectivity due to slow-speed internet connectivity in their respective locality and the inability of the students to avail reliable gadgets and internet service providers. After all, they are economically challenged or constrained.

This study aims to investigate the relationship between BS Economics students' internet connectivity and their socioeconomic characteristics. Are economic characteristics of students such as family income, educational background of the parents, and family size factors that affect the student's avail dependable internet facility? Likewise, this study will analyze the relationship between internet connectivity to academic performance. Can students with strong internet connectivity achieve high academic performance compared with students with poor connectivity? Is internet connectivity a major concern for the effective learning of students?

BS Economics is one of the programs offered by the College of Business Economics and Management of Bicol University. It is a curricular program that provides knowledge of economic theory and the standard methods in economic research to demonstrate the ability to diagnose economic problems using appropriate theories and methodologies, effectively communicate economic arguments and research results, appreciate, and practice good citizenship, and provide a deep commitment to maintaining high ethical standards, especially in constituting, analyzing and interpreting economic data and results. The realization of the objectives of the programs depends on the quality of the delivery of instruction. Hence, the complete online delivery of instruction during this period of a pandemic may affect the quality of the learning environment and learning process of the BS Economics students.

### **Materials and Methods**

The study used primary data gathered through the Google/online survey to the BS Economics at Bicol University College of Business Economics for the 2nd Semester of 2021-2022. Online surveys to the students were utilized as an alternative medium to conduct the survey that follows the health protocol requirement given the threat of the COVID-19 pandemic.

The population of the study is 341 BS Economics students from 1st year to 3rd year of the 1st Semester of 2021-2022. Using Slovin Formula at a 95% level of confidence and a 5% margin of error, the sample size is 181. The selection of respondents was determined by using a stratified proportional sampling technique and simple random sampling.

A survey instrument was used to measure and categorize the socio-economic characteristics of the students, and their internet connectivity. The following is the process to determine the internet speed latency per student: (1) a lecture on the topics (synchronous) of the major subjects in BS Economics was conducted before the examination; (2) before the examination, the students run their internet speed which includes the upload and download; and latency through using the google platform: <https://www.speedtest.net/#>; (3) after the examination, the students run again the above-mentioned platform; and (4) the average speed and latency will be determined which consist of the data of the speed and latency before and after the examination.

The academic performance was measured based on the results of the short quiz/summative examinations. The examinations were conducted in two periods last week of March 2021 and 1st week of May 2021. The result of the quiz was categorized as excellent, very satisfactory, satisfactory, and fair. Please Table 1 for the specific description. The conduct of the quiz or examination was coordinated with the subject facilitators/professors of the core courses in BS Economics for this 1st Semester of 2021-2022. At each year level, it has identified one major subject of BS Economics which is considered the subject, and a particular topic is highly dependent on a stable internet connection.

To describe the BS Economics students' socio-economic characteristics, internet connectivity, and academic performance descriptive statistics will be used to summarize the categorical variables into frequencies and percentages. To measure the correlation between internet connectivity and socio-economic characteristics, it has used a point-biserial correlation. It is because internet connectivity is a dichotomous variable and socioeconomic

characteristics are continuous variables. Point-biserial correlation is used to measure the strength and direction of the association that exists between one continuous variable and one dichotomous variable (Point-Biserial Correlation in SPSS Statistics - Procedure, Assumptions, and Output Using a Relevant Example, n.d.).

While the relationship between internet connectivity and academic performance and internet connectivity to socio-economic characteristics with categorical measures the Chi-Square Test of Association was used. This is because both variables are categorical. It determines whether there is an association between categorical variables. This test has also utilized a contingency table to analyze the data (Chi-Square Test for Association Using SPSS Statistics, n.d.).

## Results and Discussions

### A. Socio-Economic Characteristics of the Family of the BS Economics Students

#### A.1 Family Size

Table 1 shows the measure of central tendency and variability of the family size of the respondents. The mean (5.54) is greater than the median (5), and the mode (5). It means that the distribution is positively skewed (1.48). The few many numbers of family size tend to shift the mean to the right. The average family size of 5.54 of the BS Economics Students is above the Bicol Region average family size of 4.8 persons country's average family size of 4.4 persons (PSA 2015).

The largest family size is 16 and the smallest family size is 2. Hence, the range is 14. The sample variance is 3.80 which means that the data points tend to be very close to the mean and each other. The standard deviation is 1.95 which means that the BS Economics students are homogenous in their family size.

**Table 1. Descriptive Statistics of the Family Size of the Students of BS Economics**

Family Size	
Mean	5.54
Standard Error	0.5
Median	5
Mode	5
Standard Deviation	1.95
Sample Variance	3.80
Kurtosis	4.53
Skewness	1.48
Range	14
Minimum	2
Maximum	16
Sum	1002
Count	181

#### A.2 Family Monthly Income

Figure 1 shows the monthly income of the Family of BS Economics Students. According to the Philippine Institute for Development Studies (PIDS 2020), a family income of less than 10,597 per month belongs to poor families because their per capita income is less than the official poverty threshold. Based on the results, there are 41% of the students can be considered poor.

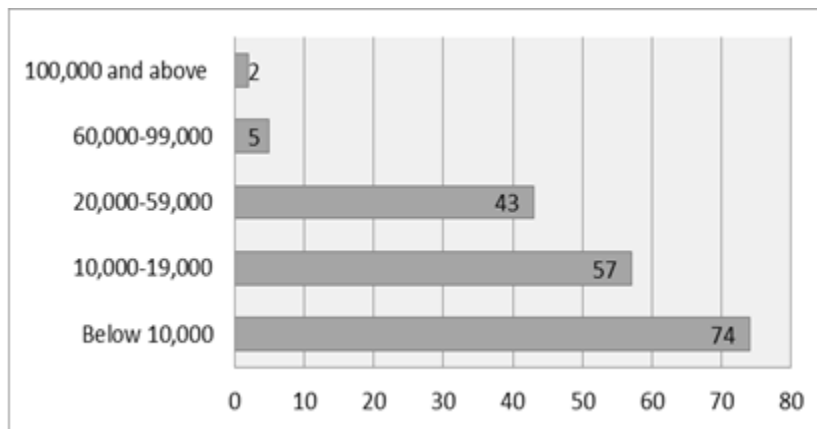


Figure 2- Monthly Income of the Family of BS Economics Students

However, according to PIDS those families with a monthly income of P10,957 to P21,914 are low-income but not poor families, this comprises more than 31% of the families of BS Economics Students. Those families with a monthly income of P21,914 to 43,828 are considered low-middle-income families, and those with a family monthly income of P43,828 – 76,699 are categorized as middle-middle-income. Based on the data there are about 24% of the families of students can be considered low-middle-income families, and 3% belong to middle-middle-income families. There only 1% can be categorized as upper middle income.

### A.3 Educational Background of the Parents

#### A.3.1 Educational Background of the Mothers of the Students

Table 2 shows that the majority of the mothers of the BS Economics students have attended or/and graduated higher level of education of which 16% were undergraduates of college, 39% were college graduates, and 3% with post-graduate degrees. However, less than a quarter of the mothers of the students have attended or/and have graduates of secondary and primary levels of education. According to the study (Korupp et al., 2002) about the influence of the mother’s educational and occupational status on children’s educational attainment, the results show that it is significant.

**Table 2. Educational Attainment of the mothers of the students**

Educational Attainment of the mother	Frequency Count	Percentage
Post Graduate Degree	6	3%
College Graduate	71	39%
College Undergrad	29	16%
High School Graduate	34	19%
High School Undergrad	25	14%
Elementary Graduate	11	6%
Elementary Undergrad	5	3%
Total	181	100%

#### A.3.2 Educational Background of the Fathers of the Students

Table 3 describes that more than half of the fathers of the students have attended and/or graduated from a higher level of education of which 19% are college undergraduates, 38% are college graduates, and 1% with a post-graduate degree. Almost half of the fathers of the graduates have attended and/or graduated from primary and secondary education.

**Table 3. Educational Attainment of the Fathers of the Students**

<b>Educational Attainment of the Father</b>	<b>Frequency Count</b>	<b>Percentage</b>
Post Graduate Degree	2	1%
College Graduate	68	38%
College Undergrad	34	19%
High School Graduate	27	15%
High School Undergrad	24	13%
Elementary Graduate	13	7%
Elementary Undergrad	13	7%
Total	181	100%

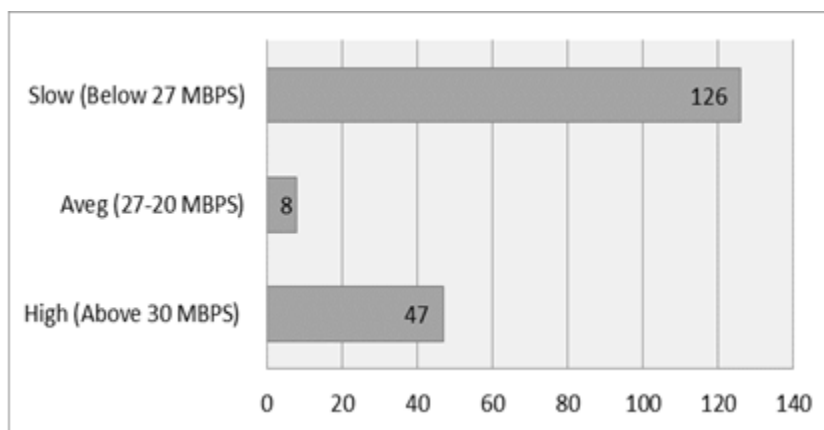
**B. Internet Connectivity**

Internet connectivity of students of BS Economics refers to their internet access, internet facility/devices and their usage, and internet provider. It described the situation of the students on the technical aspects of carrying out their online learning in terms of the degree of speed and delay of the internet connection, the capacity of their internet gadgets/devices, and the internet connection for online learning.

**B.1 Internet Access**

Internet access pertains to the internet speed per megabits per second (Mbps) and the ping (latency), the time it takes for a data set to be transmitted from your device to a server on the internet and back to the device, and it measured by milliseconds (ms).

**B.1.1 Internet Speed (Mbps)**



**Figure 3 - Average Speed of the Internet Connection of Upload and Download and During and After the Examination**

Figure 3 shows the average megabits per second (Mbps) speed of internet connectivity before and after the examination. It consists of the speed of upload and download. Based on the results, 70% of the students have experienced slow internet speed which is below 27 Mbps. While only 26% have encountered high internet speed above 30 Mbps.

### B.1.2 Latency (Ping)

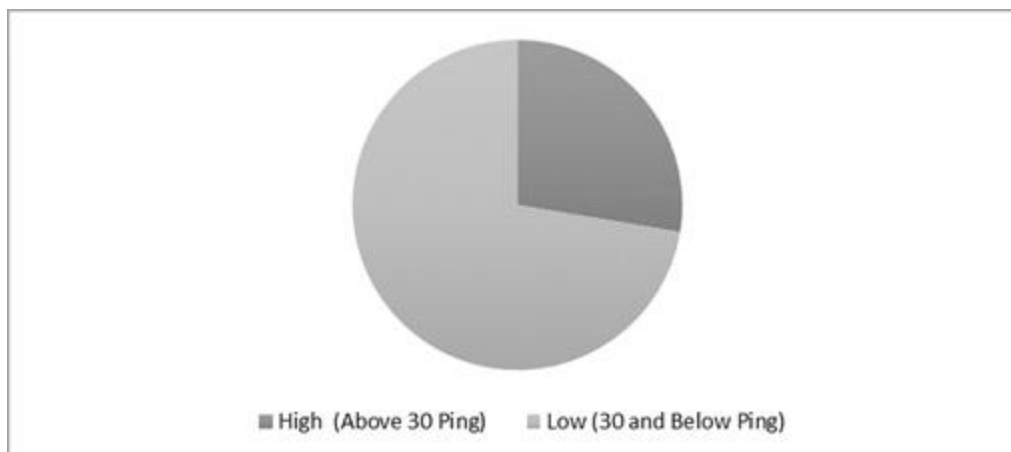


Figure 4- Average Latency of Internet Connectivity During and After the Examination

Figure 4 describes the average latency of the internet connectivity of the students before and after the examination. Less than half (28%) of the students have experienced high latency. It means it requires more time for the data to be transferred between its source and its destination. It is the amount of delay it takes to send information from one point to the next point. While more than half (72%) have encountered low latency. It means there is a minimal delay in transferring the information to its destination.

## B.2 Internet Facility and Usage

### B.2.1 Gadget Use for Internet Connection

Figure 5 shows that 88% of the students use smartphones for their online learning. While 12% of the students are using laptops & tablets for online learning. It implies that the majority of the students are using smartphone gadgets for synchronous and asynchronous online classes. The reasons why the majority of the students are using smartphones may be because they lack resources to avail laptops, or it is because smartphones are convenient for the students to carry anywhere and easy for them to monitor their classes both in Google Classroom and various social media platforms such as Facebook Messenger.

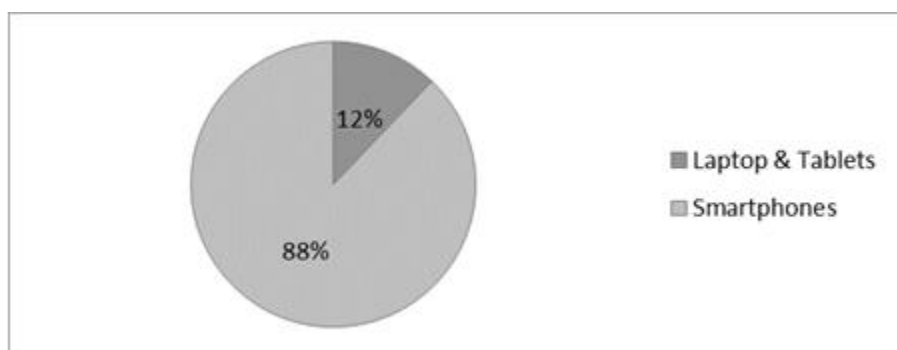


Figure 5- Electronic Devices/Gadgets Use of Online Learning of the BS Economics Students

### B.2.2 Number of Hours Devoted for Online and Non-online Learning.

Table 4 illustrates the number of hours the students devoted their time to online learning per week. More than half of the students have devoted their time to online learning from 2 hours to 6 hours of which 33% from 2 to 4 hours, and 33% from 4 to 6 hours. It refers to the allotted time for the students to engage in Google Classroom or other online

platforms used by the professors to conduct their lessons. This may imply that the predominant online learning modality is asynchronous. Other students have allotted their time more than 6 hours and less than 2 hours.

**Table 4. Devoted Time for Online Learning of the Students in a Week**

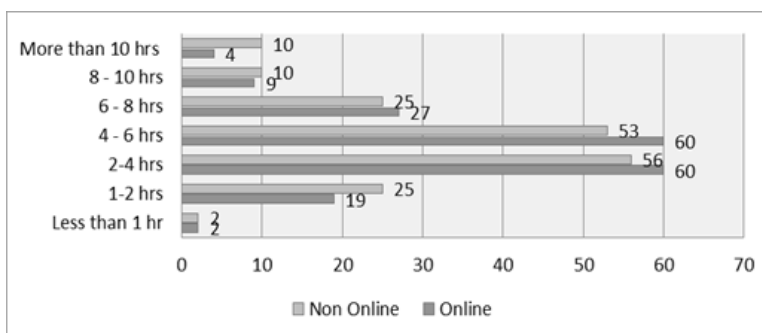
Devoted Time for Online	Frequency	Percentage
Less than 1 hour	2	1%
1 - 2 hours	19	10%
2 - 4 hours	60	33%
4 - 6 hours	60	33%
6 - 8 hours	27	15%
8 - 10 hours	9	5%
More than 10 hours	4	2%
<b>Total</b>	<b>181</b>	<b>100%</b>

For those students who have devoted more time to online learning, they may have maximized their engagement in online learning because of the stable internet connection. While for those students who have less time in online learning, this may be because of a slow internet connection, or they have fewer resources to avail internet data.

**Table 5. Devoted Time for Non-Online Learning of Students in a Week**

Devoted Time for Non-Online	Frequency	Percentage
Less than 1 hour	2	1%
1- 2 hours	25	14%
2 - 4 hours	56	31%
4 - 6 hours	53	29%
6 - 8 hours	25	14%
8 - 10 hours	10	6%
More than 10 hours	10	6%
<b>Total</b>	<b>181</b>	<b>100%</b>

Table 5 shows the number of hours the students devoted their time to non-online learning per week. More than half of the students have devoted their time to online learning from 2 hours to 6 hours of which 31% from 2 to 4 hours, and 29% from 4 to 6 hours. Other students were allotted more than 6 hours and less than 2 hours in non-online learning. It refers to the time they allocated in a week to read their instructional materials, complete their learning activities, and study their lessons.



**Figure 6 - Devoted Time for Online and Non-online Learning of BS Economics Students**

Figure 6 shows that most of the students allocated 2 to 6 hours both in online and non-online learning. The number of students is more with online learning than with non-online learning in the following category of hours they spent learning 2 to 4 hours, 4 to 6 hours, 6 to 8 hours, and 8 to 10 hours. While those students who have devoted their time to learning for 1 to 2 hours, and more than 10 hours, spent more time on non-learning rather than online learning.

**B.2.3 Number of Family Members Using the Internet Simultaneously**

Table 6 shows the measure of central tendency and variability of the number of family members using the internet simultaneously. The mean (4.07) is greater than the median (4) and the mode (3). It means that the distribution is positively skewed (0.68). The few many numbers of family members using the internet at the same time tend to shift the mean to the right. Many numbers of people who share the connection at the same can be considered as a factor that may slow the internet connection.

**Table 6. Descriptive Statistics of the Number of Family Members Using the Internet Simultaneously**

<i>Number of Using the Internet Simultaneously</i>	
Mean	4.07
Standard Error	0.14
Median	4
Mode	3
Standard Deviation	1.64
Sample Variance	2.67
Kurtosis	0.28
Skewness	0.68
Range	7
Minimum	1
Maximum	8
Sum	736
Count	181

The highest number of family members using simultaneously their internet connection is 8 and its lowest is 1. Hence, the range is 7. The sample variance is 2.67, which indicates that the data points tend to be very close to the mean and each other. The standard deviation is 1.64 which means that the BS Economics students are homogenous in terms of the number of family members using the internet connection at the same time.

**B.3 Internet Providers**

Figure 7 shows that the majority of the students are using mobile networks as their internet service providers. Most of the respondents subscribed to Globe with 69 students while others subscribed to Smart with 55 students as their network connection. They are using data from their smartphone network or WIFI connection of the mobile network. Other internet service providers are DCTV with 38 students and converge with 19 students subscribers.

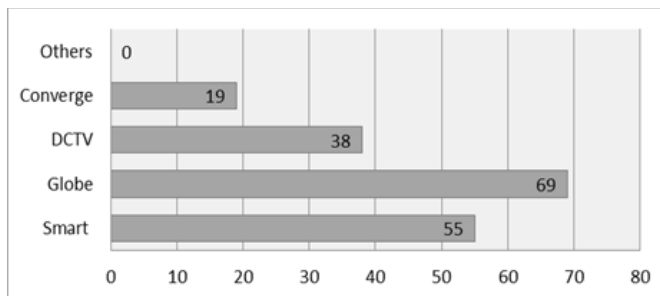


Figure 7 - Internet Service Provider to the Online Learning of BS Economics Students



### C. Academic Performance

Figure 8 shows that from the two examinations conducted on the students, 83% got an excellent performance, and 15% gained a very satisfactory performance. This is followed by 2% satisfactory and 1% fair. It implies that the majority of the students have passed the examinations and received a high score.

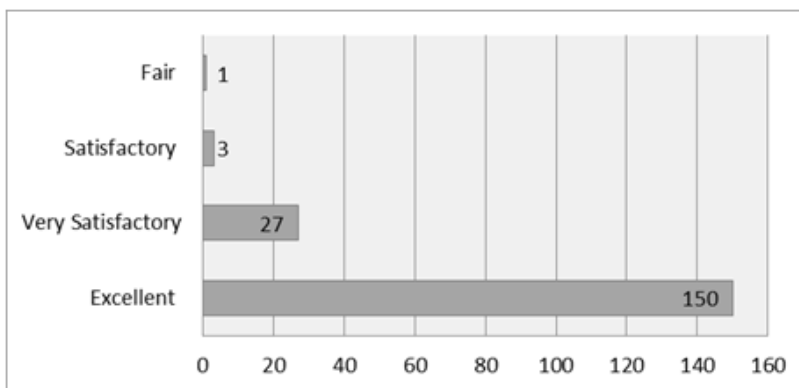


Figure 8 - Academic Performance of the BS Economics Students During the Online Learning Modality

Table 7 shows the descriptive statistics of the total raw score of the summative examinations of the students of BS Economics. It has two sets of examinations with a total raw score of 100. Based on the results the mean score of the 181 students is 92.51 which is categorized as very satisfactory academic performance for the selected major subjects of BS Economics during the online delivery due to the COVID-19 pandemic. The raw score of 95 is the most frequent score of the students which is categorized as very satisfactory performance. The mean (92.51) is less than the mode (95), and the mean is less than the median (95), which shows that the distribution is negatively skewed (-1.36). The few low raw scores of the students tend to shift the mean to the left.

**Table 7. Descriptive Statistics of the Total Raw Score of the Summative Examinations of the Students of BS Economics**

<i>Exam Score (100 Items)</i>	
Mean	92.51
Standard Error	1.39
Median	95
Mode	95
Standard Deviation	9.62
Sample Variance	92.51
Kurtosis	3.43
Skewness	-1.36
Range	40
Minimum	60
Maximum	100
Sum	16,745
Count	181

The highest score is 100 which is the perfect score, and the lowest score is 60 which belongs to the category of fair academic performance. Hence, the range of score is 40. The sample variance is 92.51, which means that the data points are equal to the mean. The standard deviation is 9.62 which means that the total raw score of the BS Economics students is a bit heterogeneous.

D. Correlation/Association Between Students’ Socio-Economic Characteristics and Internet Connectivity

The test of correlation or association between internet connectivity and students' socioeconomic characteristics aims to determine whether a relationship exists between these two variables. Internet connectivity consists of measures with each category of speed and latency. The socio-economic characteristics include family size, monthly income, and educational background of the parents of the students.

D.1 Correlation Between Family Size and Internet Connectivity (Speed)

A Point Biserial correlation (r) was used to determine the correlation between internet connectivity and family size. The family size is a continuous variable that refers to the number of family members while the internet connectivity is dichotomized into high speed and low speed. The hypothesis is as follows:

- Ho: There is no relationship between family size and internet connectivity.
- Ha: There is a relationship between family size and internet connectivity.

The result of  $r = -0.13704$  and its p-value is  $.06583$ . The result is not significant at  $p < .05$ . Therefore, it fails to reject the null hypothesis and cannot accept the alternative hypothesis. It means that there is no relationship between family size and internet connectivity.

D.2 Association Between Monthly Income and Internet Connectivity (Speed)

A Chi-square test of association was used to determine the association between monthly family income and internet connectivity. Internet connectivity is categorized into average & high speed and slow speed. While the income is categorized into below P10,000; P10,000 to 19,000; and P20,000 to 59,000 & 60,000 above. The hypothesis is as follows:

- Ho: There is no association between monthly family income and internet connectivity.
- Ha: There is an association between monthly family income and internet connectivity.

The results are as follows:

**Table 8. Observed Association Between Monthly Income and Internet Connectivity**

Income	Ave & High-Speed Internet Connection	Slow Speed Internet Connection	Total
Below 10,000	17	57	74
10,000-19,000	21	36	57
20,000-59,000 & 60,000 above	17	33	50
Total	55	126	181

**Table 9. Expected Association Between Monthly Income and Internet Connectivity**

Income	Ave & High-Speed Internet Connection	Slow Speed Internet Connection	Total
Below 10,000	22.49	51.51	74
10,000-19,000	17.32	39.68	57
20,000-59,000 & above	15.20	34.80	50
Total	55	126	181

The chi-square statistic (X<sup>2</sup>) is 3.3543 and its p-value is  $.186907$ . The result is not significant at  $p < .05$ . Therefore, failed to reject the null hypothesis and cannot accept the alternative hypothesis. It means there is no association between monthly family income and internet connectivity. To measure the magnitude of the association between the

monthly family income and internet connectivity, Cramer’s V was used. The result is  $V= 0.14$ . Hence, there is a weak association between the two variables.

D.3 Association Between Educational Background of the Parents of the Student and Internet Connectivity

A Chi-square test of association was used to determine the association between the educational background of the parents of the students and internet connectivity. This is in the context that the educational background of parents may influence the acquisition of a stable internet connection. This is because higher educational attainment can be considered as one of the factors of having a stable income, hence having the capacity to avail reliable internet connection. Likewise, higher educational attainment indicates higher awareness of the parents to secure a good internet connection.

D.3.1 Association Between Educational Attainment of the mothers of the Student and Internet Connectivity

The educational attainment of the mothers of the students is categorized into elementary undergraduate and elementary graduate; undergraduate in high school and high school graduate; and undergraduate in college, college graduate, and post-graduate degree. While internet connectivity is classified into average & high internet speed and slow internet speed. The hypothesis is as follows:

Ho: There is no association between the educational attainment of the mothers of the students and internet connectivity.

Ha: There is an association between the educational attainment of the mothers of the students and internet connectivity.

The results are as follows:

**Table 10. Observed Association Between Educational Attainment of the mothers of the Student and Internet Connectivity**

<b>Educational Attainment of the mothers</b>	<b>Ave&amp; High Internet Speed</b>	<b>Slow Internet Speed</b>	<b>Total</b>
Undergraduate in College, College Graduate, and Postgraduate	38	68	106
Undergraduate in High School and HS Graduate	14	45	59
Elementary Undergraduate and Elementary Graduate	3	13	16
<b>Total</b>	<b>55</b>	<b>126</b>	<b>181</b>

**Table 11. Expected Association Between Educational Attainment of the Mothers of the Student and Internet Connectivity**

<b>Educational Attainment of the Mothers</b>	<b>Ave&amp; High Internet Speed</b>	<b>Slow Internet Speed</b>	<b>Total</b>
Undergraduate in College, College Graduate, and Postgraduate	32.21	73.79	106
Undergraduate in High School and HS Graduate	17.93	41.07	59
Elementary Undergraduate and Elementary Graduate	4.86	11.14	16
<b>Total</b>	<b>55</b>	<b>126</b>	<b>181</b>

The chi-square statistic ( $X^2$ ) is 3.7558 and its p-value is 0.152912. The result is not significant at  $p<.05$ . Therefore, failed to reject the null hypothesis and cannot accept the alternative hypothesis. It means there is no association between the educational attainment of the mothers of the students and internet connectivity.

To measure the magnitude of association between the educational attainment of the mothers of the student and internet connectivity., Cramer’s V was used. The result is  $V= 0.144$ . Hence, there is a very weak association between the two variables.

D.3.2 Association Between Educational Attainment of the Fathers of the Student and Internet Connectivity

The educational attainment of the fathers of the students is categorized into elementary undergraduate and elementary graduate; undergraduate in high school and high school graduate; and undergraduate in college, college graduate, and post-graduate degree. Internet connectivity is classified into average & high internet speed and slow internet speed.

The hypothesis is as follows:

Ho: There is no association between the educational attainment of the fathers of the student and internet connectivity.  
 Ha: There is an association between the educational attainment of the fathers of the student and internet connectivity.

The results are as follows:

**Table 12. Observed Association Between Educational Attainment of the Fathers of the Student and Internet Connectivity**

Educational Attainment of the Fathers	Ave& High Internet Speed	Slow Internet Speed	Total
Undergraduate in College, College Graduate, and Postgraduate	30	74	104
Undergraduate in High School and HS Graduate	15	36	51
Elementary Undergraduate and Elementary Graduate	9	17	26
Total	54	127	181

**Table 13. Expected Association Between Educational Attainment of the Fathers of the Student and Internet Connectivity**

Educational Attainment of the Fathers	Ave& High Internet Speed	Slow Internet Speed	Total
Undergraduate in College, College Graduate, and Postgraduate	31.03	72.97	104
Undergraduate in High School and HS Graduate	15.22	35.78	51
Elementary Undergraduate and Elementary Graduate	7.76	18.24	26
Total	54	127	181

The chi-square statistic (X<sup>2</sup>) is 0.3368 and its p-value is .845027. The result is not significant at p<.05. Therefore, failed to reject the null hypothesis and cannot accept the alternative hypothesis. It means there is no association between the educational attainment of the fathers of the student and internet connectivity.

To measure the magnitude of association between the educational attainment of the fathers of the student and internet connectivity, Cramer’s V was used. The result is V= 0.043. Hence, there is a very weak association between the two variables.

E. Association between Internet Connectivity and Academic Performance

The Chi-square test of association was used to measure the association between internet connectivity and academic performance. It aims to analyze if internet connectivity may affect the results of the summative examination of the students.

E.1 Average Internet Speed and Academic Performance

The average internet speed is categorized as average & high speed and slow speed. While academic performance is grouped as excellent, very satisfactory, satisfactory, and fair. The following is the hypothesis:

Ho: There is no association between average internet speed to academic performance

Ha: There is an association between average internet speed to academic performance

The results are as follows.

**Table 14. Observed Association between Average Internet Speed and Academic Performance**

Internet Speed (Mbps)	Excellent	Very Satisfactory	Satisfactory and Fair	Total
Average & High Speed	44	9	2	55
Slow Speed	106	18	2	126
<b>Total</b>	<b>150</b>	<b>27</b>	<b>4</b>	<b>181</b>

**Table 15. Expected Association between Average Internet Speed and Academic Performance**

Internet Speed (Mbps)	Excellent	Very Satisfactory	Satisfactory and Fair	Total
Average & High Speed	45.58	8.20	1.22	55
Slow Speed	104.42	18.80	2.78	126
<b>Total</b>	<b>150</b>	<b>27</b>	<b>4</b>	<b>181</b>

The chi-square statistic ( $X^2$ ) is 0.9169 and its p-value is 0.632254. The result is not significant at  $p < .05$ . Therefore, failed to reject the null hypothesis and cannot accept the alternative hypothesis. It means that there is no association between internet speed and the student’s academic performance. Cramer’s V was used to measure the magnitude of association between the internet speed and the student’s academic performance. The result is  $V = 0.071$ . Hence, there is a very weak association between the two variables.

E.2 Average Latency and Academic Performance

The average latency is categorized as average & high latency and slow and low latency. While the academic performance in the group was excellent, very satisfactory, satisfactory, and fair. The following is the hypothesis:

Ho: There is no association between average latency to academic performance

Ha: There is an association between average latency to academic performance

The results are as follows,

**Table 16. Observed Association between Average Latency and Academic Performance**

Latency (Ping)	Excellent	Very Satisfactory	Satisfactory and Fair	Total
Average & High Latency	40	9	1	50
Low Latency	110	18	3	131
<b>Total</b>	<b>150</b>	<b>27</b>	<b>4</b>	<b>181</b>

**Table 17. Expected Association between Average Latency and Academic Performance**

Latency (Ping)	Excellent	Very Satisfactory	Satisfactory and Fair	Total
Average & High Latency	41.44	7.80	1.10	50
Low Latency	108.56	19.54	2.90	131
<b>Total</b>	<b>150</b>	<b>27</b>	<b>4</b>	<b>181</b>

The chi-square statistic ( $X^2$ ) is 0.5227 and its p-value is .769998. The result is not significant at  $p < .05$ . Therefore, failed to reject the null hypothesis and cannot accept the alternative hypothesis. This means that there is no association between latency and the student's academic performance.

Cramer's V was used to measure the magnitude of association between the internet speed and the student's academic performance. The result is  $V = 0.054$ . Hence, there is almost no association between the two variables.

### Conclusion

The socio-economic characteristics of the students have an association with internet connectivity in terms of the father and mother's monthly income and educational attainment. At the same time, the evidence shows that internet connectivity has no association with academic performance.

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