COMPARATIVE ANALYSIS OF MALE AND FEMALE STUDENTS IN PROGRAMMING ABILITY

BUOYE P. A.[1] and OJUAWO O.O.[2]

The Federal Polytechnic, Ilaro,
Computer Science Department, federal poly, ilaro, Nigeria.
[1] adewuyi.buoye@federalpolyilaro.edu.ng
[2] olutayo.ojuawo@federalpolyilaro.edu.ng

ABSTRACT

The gender gap in the population of the admitted students as it was observed in computer science department in federal polytechnic, ilaro is wide. In 2015, it was 25 male to 7 female, in 2016, it was 37 male to 8 female, in 2017, it was 38 male to 15 female and in 2018, 57 male to 9 female. This variation was thought to be due to lower academic performance of female students. The comparative study of the performance of both male and female students in a programming language (COM113) from the computer science department of the federal polytechnic, ilaro, over a period of four (4) years shows that the performance of the female students is at pal with the performance of male students. The results of four sessions were analyzed using the statistical mean and standard deviation. The mean of means for the performance of male and female are 52.82 and 51.38 respectively while the standard deviations are 11.37 and 11.31 for male and female respectively. T-test values of com 113 (from 2015-2018) of male and female students shows a significant difference while the p-value of the t-test is above the 0.005 which shows that there is no statistically significant relationship between the students' performance in computer programming and the population ratio of male to female.

Key words: gender gap, statistical mean, programing language, T-test, Comparative study.

1.   INTRODUCTION

According to Wikipedia, Women in Nigeria have had various challenges in order to obtain equal education in all forms of formal education in Nigeria. Education gives on women the tendency to acquire knowledge, competence with skills. The National Policy on Education states that access to education is a right for all Nigerian children irrespective of gender, religion and disability in other to make sure that there is equal access to education, (Wikipedia). During the advent of computer technology (during the world war II), women formed most of the workforce. Today, when computer is virtually everywhere, the interest of female in computing seems to be diminish. Ates, (2017) said that Women invented the field. Then men pushed them out of it. The contributions of Ada Lovelace, In 1843, Hedy Lamarr,in 1942, Jean Bartik,In 1945–46,Rear Admiral Grace Hopper, In 1952, to mention but few, cannot be over emphasized. These are women who actively worked to invent or co-invent computer technology. As technology and practices altered, the role of women as programmers has changed, and the recorded history of the field has downplayed their achievements (Ates, 2017).

At federal polytechnic, ilaro, the population of the admitted students into the department of computer science over a period of four (4) sessions were examined and the ratio of male to female in 2015/16, 2016/17, 2017/18 and 2018/19 are 4:1, 5:1,3:1 and 6:1 respectively.

From the ratio above, the number of male students out-weighed that of the female students. Could the reason be low academic performance on the part of the female students? The empirical analysis of the performance of male students to female students in programing language courses shows that women are not week academically.

2.   LITERATURE REVIEW

Greg and Jesse (1996) said, worldwide, there is a significant discrepancy between the numbers of male and female graduates from computer science programs. The researchers also gave brief analysis of male to female ratio in SUNY Geneseo. The members of the the Computer Science Department informally observed that: although roughly 2/3's of the college's students are women and roughly 1/2 of all students in introductory computer science courses are women, less than 1/4 of the students who graduate with degrees in computer science are women (Greg and ajesse,1996).

 According to Korkmaz and Altun (2013) as cited by Akinola (2016), the way Women are represented in the field of Computer Science is not encouraging. One of the several factors that might explain the reason for low participation of women in computing is their attitude toward computing. Programming is not alluring to females. This could be

attributed to females' low confidence and programming abilities. Therefore, their attitudes towards programming are more negative than males (Akinola.2016).

There are a lot of women pursuing various courses in science and engineering over the past decades, but very few of them are among majors and baccalaureate degree holders in fields outside the social, behavior, and life sciences (fox and sonnert, 2012). Gender differences in students' participation and performance in undergraduate education within science and engineering is an important subject in the study of gender and higher education (fox and sonnert, 2012).

Gender has been found to influence the academic performance of male and female students, and has in turn called the attention of institutions of higher learning, governments and individuals in recent times, to investigate the extent to which gender influences academic performance (Kwesi ,Sam, Osei, and Kattah,2019). Traditionally, male students' academic achievement was considered superior to that of female students, especially in Mathematics and Science, because of their higher levels of innate spatial abilities (Benbow & Stanley, 1980), as reported by Kwesi *et.al,* (2019).

Gender studies tend to have implications to support research, curriculum enrichment and redesign, future teaching methods, and the academic study of gender across all disciplines. In the educational setting, results of researches conducted to compare male and female students' performance inform much about which gender group is failing or succeeding in the discipline under study. The results from gender studies influence teaching methods as subject instructors also play major roles in students' performances (Kwesi et.al, 2019).

In their paper; Gender Differences in Academic Performance in a Large Public University in Turkey, Meltem and Serap (2004), established that despite their lower university entrance scores and under-representation in most departments, female undergraduate students outperform their male counterparts during their college years.

Nnamani and Oyibe, (2016) in their research revealed that both students and teachers' gender have effects on secondary school students' mean achievement and recommended that Government should put gender equality in consideration while recruiting teachers.

Wangu, (2014), defined academic performance as the quality and quantity of knowledge, skills, techniques and positive attitudes, behavior and philosophy that students achieve or acquire.

This achievement, according to wangu, (2014) is evaluated by the mark or grade that students attain in a term or education cycle and their level of academic performance is determined by the quality of grades and the number of students that pass.

Simmons (2010) Concluded that the female students reported more positive ratings for academic self-perception and valuing school goals than the male students. Despite these differences, there was no significant difference in the achievement levels of male and female students.

3.   RESEARCH METHODOLOGY

Subjects: The subject used for this research is introduction to programming (COM113). ND1 (100 Level) students of Computer Science who are just learning how to program were used because the Students got little or no prior knowledge of computer programming. They were lectured for a period of 10-weeks, including practical classes in this programming Language. Their performance was studied over a period of four (4) semesters (first semester for four years) and the statistical mean and standard deviation was calculated and then compared.

In this work, we try to find out analytically if low population of the female gender will really affect the programming skill ability of female students using the results of introduction to programming (COM113) of first semesters of four (4) sessions and analyzed the performances of male and female students.

3.1 Statement of Hypotheses

H0: There is no statistically significant relationship between the students' performance in computer programming and the population ratio of male to female.

H1: There is statistically significant relationship between the students' performance in computer programming and the population ratio of male to female.

3.2 Research Design

The subject used for this research is introduction to programming (COM113). ND1 (100 Level) students of Computer Science who are just learning how to program were used because the Students got little or no prior knowledge of computer programming. They were lectured for a period of 10-weeks, including practical classes in this programming Language. Their performance was studied over a period of four (4) semesters (first semester for four years) and the statistical mean and standard deviation was calculated and then compared. Data collected comprises of the examination score of the students graded 100% as the mark obtainable. The collected data is represented using grouped data as shown in Table 1. Equation (1) (2) (3) and (4) are the formulas of mean, variance, standard deviation and t-test which are the statistical measures used to analyze the collected data.

3.3 Data Collection Procedures

The data of students in introduction to programming categorized under male and female students were obtained directly from the result sheets for the years 2015-2018 from the department of computer science, federal polytechnic, ilaro. These categories were used as a measure of academic performance.

This study made use of secondary data in the form of the scores of students from result score sheets (RSS) obtained from the department of computer science, the federal polytechnic, ilaro for the years 2015-2018. Secondary data analysis can save time that would otherwise be spent on collecting data.

3.5 Data Processing and Analysis

In order to prove our hypothesis right or wrong, the research questions that guided the study, the data that was obtained from the department was processed using the statistical data tools of the Microsoft excel. A combination of descriptive and inferential statistics, were used to analyse the data to provide results. The hypothesis focused on determining whether there is a statistically significant difference in the academic performance of male and female students in introduction to programming, (programming ability) for the years 2015-2018 and was analysed with the use of independent samples t-test.

The statistical tools used are the formulae for mean score, standard deviation, t-value and degree of freedom which are;

$$\text{Mean } (\bar{X}) = \frac{\Sigma fx}{\Sigma f} \tag{1}$$

$$\text{Variance } (\sigma 2) = \frac{\Sigma f(X-\overline{X})2}{\Sigma f - 1} \tag{2}$$

$$\text{Standard Deviation} = \sqrt{\sigma 2} \tag{3}$$

Where $\bar{X}$ = the Mean and X = class mid-mark

T-value

$$t - value = \frac{mean1 - mean2}{\sqrt{\frac{(var1)2}{n1} + \frac{(var2)2}{n2}}} \tag{4}$$

Here mean1 and mean2 = {Average values of each of the sample sets}

Var1 and Var2 = {Variance of each of the sample sets}

n1 and n2 = {Number of records in each sample set}

4.   RESULTS AND DISCUSSION

4.1 Demography of Respondents

The gender of the introduction to programming students was the only demographic variable that was collected. This was meant to give a clear indication of the total number of male and female students who sat for the exams in the years, 2015, 2016, 2017 and 2018. The results that were obtained are presented in Table 1.

Table 1:Frequency distribution of the performances of male and female students over a period of 4 years

CLASS	VALUE	2015		2016		2017		2018	
COM 113		M	F	M	F	M	F	M	F
0-39	37	1	2	3	1	3	2	2	0
40-44	42	9	3	10	2	15	2	6	1
45-49	47	6	0	3	1	6	3	7	1
50-54	52	1	0	5	2	5	1	8	2
55-59	57	3	1	3	1	2	4	10	3
60-64	62	1	0	2	0	3	2	9	0
65-69	67	4	0	4	0	1	1	8	1
70-74	72	2	1	4	0	2	0	1	0
75-100	77	0	0	3	1	1	0	6	1
TOTAL		27	7	37	8	38	15	57	9

Total number of 34 students were admitted to the department of computer science in 2015, the total number of students who sat for COM 113(introduction to programming), which included 27 (79%) male students and 7 (21%) female students. From Table 1above, 2018 recorded the highest number of students who sat for the exam as compared to the other years under study. The reason for this was the increments in the number of streams approved for the department by the NBTC. The number of students who sat for the exam in the respective years is as indicated in the table 1. There was increase in the number of male students from 2015 to 2016 by percent (37%) and the female students had fourteen percent increase (14%). From 2016 to 2017 male students recorded a 3% increase in the number and the number of female students also increased by 87%. Likewise 2017 to 2018, the number of male students increased by 50% and the number of females also decreased by 40%.

From all the respective years studied, the population of male students dominated that of female students. Out of a total population of 198 from the department, the male students represented 159 and the female students represented 39, showing clearly that there are more male students studying computer science than female students in the computer science department of the federal polytechnic, ilaro.

Data was collected on students' scores in COM 113 with respect to the four year period and was analysed with the use of means and standard deviations. Table 2 presents the results that were obtained.

Table2: Mean scores and the standard deviation of students marks in Com113 (2015-2018)

YEAR		2015	2016	2017	2018	Mean of Mean/SD
GENDER (MEAN SCORE)	MALE	50.26	54.43	49.24	57.35	52.82
	FEMALE	47.00	50.75	51.33	56.44	51.38
GENDER (STANDARD DIV)	MALE	11.00	13.10	10.44	10.93	11.37
	FEMALE	12.91	12.46	9.42	10.44	11.31

From the table of the statistical mean and the deviation above (table 2), the performance of female students seems averagely at pal with male. This is an indication that the female performance in computer programming is not bad when compared with their male students.

Though the mean of MALE students is higher than that of FEMALE students (except in 2017/18), we cannot conclude that all the students have an average score around the calculated mean since the variance of MALE is significantly higher than FEMALE (with the exception of the year mentioned above). Is this difference by chance or do differences really exist in the overall population of all the performances received in the class? We establish the problem by assuming the null hypothesis that the mean is the same between the two sample sets and conduct a t-test to confirm if the hypothesis holds true.

Table 3:F-Test Two-Sample for Variances

	MALE	*FEMALE*
Mean	51.62962963	47
Variance	121.011396	166.6666667
Observations	27	7
Df	26	6
F	0.726068376	
P(F<=f) one-tail	0.260769008	
F Critical one-tail	0.404185947	

Table 4: t-Test: Two-Sample Assuming Equal Variances

	MALE	*FEMALE*
Mean	51.62962963	47
Variance	121.011396	166.6666667
Observations	27	7
Pooled Variance	129.5717593	
Hypothesized Mean Difference	0	
Df	32	

t Stat	0.958920305
P(T<=t) one-tail	0.172394259
t Critical one-tail	1.693888703
P(T<=t) two-tail	0.344788518
t Critical two-tail	2.036933334

Table 5: The p-values of the f-test and t-test (2015-2018).

YEAR	F-Test Two-Sample for Variances		t-Test: Two-Sample Assuming Equal Variances	
	F-Test	P-value	T-Test	P-value
2015	0.726	0.26	0.959	0.34
2016	1.105	0.49	0.726	1.68
2017	1.228	0.35	0.676	0.50
2018	1.096	0.49	0.232	0.41

From table 5 above, the p-value associated with the test for Two-Sample for equality of Variances. These p-values are more than 0.005 which shows that the variances can be assumed to be equal. Because of this assumed equality of variance, we proceeded to performing the t-test on each of the year performance. Since the p-values of the t-test are each more than 0.005, then the null hypothesis can be adopted while the alternative hypothesis is rejected. The results show that there is no statistically significant relationship between the students' performance in computer programming and the population ratio of male to female.

5.   CONCLUSION

Truly the way Women are represented in the field of Computer Science is not encouraging. Their attitudes towards programming are believed to be more negative than males. Our results in these research shows that there is no statistically significant difference in the performance of male and female student. There might be other factors, not covered by this research, which brings about the disparity in te population of male and female. This factor may have been the reason why the population of male students is so much higher than that of their female counterpart in the department of computer science, federal polytechnic, ilaro. Probability test (p-test) of 0.005 was used to test how significant is the difference in the performance of the two genders and the result absolutely shows no difference. 0.34, which is the smallest probability test value got from te table 5above is a large value of probability in statistics. The population we studied was restricted to students in a programming language (COM113) in the department of computer science federal polytechnic, ilaro. Finally, the study revealed that the performance in computer programming in computer science department of the federal polytechnic is not gender sensitive and the low population of female students studying computer science is not as a result of weakness in programming ability

REFERENCES

Akinola, S.O, (2015). Computer programming skill and gender difference: *An empirical study.* American Journal Of Scientific And Industrial Research. AJSIR ISSN: 2153-649X, doi:10.5251.pp 4-9.

Arthur, E.K, Sam. T, Osei, G.A and Kattah, G, (2019). Comparative analysis of male and female students' academic performance in financial accounting: *A survey in the cape coast metropolis.* International Journal of Social Science and Humanities Research ISSN 2348-3164 (online) Vol. 7, Issue 1, pp: (150-164.

Ates, F, (2017, August 9). A Brief History of Women in Computing: *Women invented the field then men pushed them out of it. Retrieved from* https://hackernoon,com.

Chirwa, E.W, (2004). Gender and Performance of Micro and Small Enterprises in Malawi. *Wadonda Consult Working Paper WC/01/04.*

Gerhard, S. and Fox, M.F, (2012). Women, Men, and Academic Performance in Science and Engineering: *The Gender Difference in Undergraduate Grade Point Averages*. *The Journal of Higher Education,* Vol. 83 No. 1 pp 74-103.

Greg, S, and Smith, J (1996). A Study of Barriers to Women in Undergraduate Computer Science.

Keshu, J.N,(2014). Survey on Gender and Academic Performance In Secondary Schools In Kenya.

Nnamani,S.C and Oyibe,O.A, (2016). Gender and Academic Achievement of Secondary School Students In Social Studies In Abakaliki Urban Of Ebonyi State. British Journal of Education Vol.4, No.8, pp.72-83.

Meltem, D.L and Serap, T.A, (20104). Gender Differences in Academic Performance in a Large Public University in Turkey.

Simmons, L.A,(2010). Academic Performance Differences Among Male and Female African American Students: *An Urban High School Study.*

Wangu, M.J,(2014). The Impact of Gender Differences On Student's Academic Performance In Secondary Schools In Ndumberi Division, Kiambu County, Kenya In Science Subjects And Languages.

Female education in Nigeria. Retrieved from https://en.wikipedia.org.