



## On The Strength of Agreement Between Students' Initial and Final Academic Performances In Nigeria University System

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### ABSTRACT

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This paper examines the strength of agreement between academic performances of students after their first and final years in the University. Academic performances of a total of 886 students that were admitted into various academic programs in the Faculty of Science, University of Ilorin, during the 2008/2009 academic session were followed-up to their year of graduation in 2012. Information on the grade point average (GPA) of students at the end of their first year in 2008, their final cumulative grade point average (CGPA) at the end of their studies in 2012 among others was collected. Results from this study generally showed a strong agreement between students initial and final academic performances in Nigeria University system ( $p < 0.001$ ). This work will serve as useful counseling guide to prospective admission seekers into the Universities and all the stakeholders at enhancing students academic performances in the University system.

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## 1. INTRODUCTION

Education, according to Oghuvbu (2007) is a systematic procedure for the transfer and transformation of culture, through formal or informal training of people in a society. It is a process that leads to mental, physical, psychological and social development of an individual in a given society. The prime objective of acquiring education all over the world is geared towards manpower development that would in turn foster national growth and development. As an instrument for the development of man and the society, the process of acquiring formal education can be compartmentalized into different hierarchical stages beginning from elementary (kindergarten) to higher (tertiary) levels (Ebong, 1996). This hierarchical structure of education differs from one country to another. At the moment, there are 114 government approved Universities in Nigeria 40 of which are established and funded by the Federal Government of Nigeria and 36 were own by the State Governments in Nigeria while 38 were owned by private concerns. These universities admit many students into their various programs and graduated a number of them with varying class of degrees annually.

Obviously, the employability of graduates from the universities largely depends on the class of degrees they had at the end of their programme, therefore, it is quite in order to examine and evaluate the processes that determine the final academic performances of the students while they are still in the Universities. The first year of students in the university is usually characterized by a long list of activities such as orientation programme, students' union activities, travelling show, having sideshows, sightseeing and rides, engaging in games of skill and the like all in a bid to get themselves acclimatize to the new school environment different from where they came from. While these activities would improve the social status of the students in the school, unfortunately they are equally capable of distracting the students from their real academic pursuit for which they were admitted into the school.

This study is therefore aimed at establishing the possible impacts of the academic performances of the students during their first year in the university on their final academic performances at the end of their programme. Results from this study would serve as self-counseling mechanisms to the newly admitted students into the universities that would enable them to effectively prioritize their social engagements vis--vis their academic activities during their first year in the university as build-up steps towards attaining academic excellence at the end of their studies in the university.

## 2. MATERIAL AND METHODS

**2.1. Data Description.** Data on results of academic performances of a total of 886 students that were admitted into various academic programs in the old Faculty of Science (which later split into Faculties of Physical and Life Sciences), University of Ilorin, Nigeria, during the 2008/2009 academic session were followed-up to their year of graduation in 2012. In this study, these two faculties shall be referred to as Faculty of Science in subsequent discussions. In addition to gender, information on the Grade Point Average (GPA) obtained by these students at the end of their first year in the University in 2008, the final Cumulative Grade Point Average (CGPA) they graduated with at the end of their studies in 2012, and their modes of entry into the University was collected. Of all the 886 students in this study, 335 (about 38%) were females while the remaining 551 (about 62%) were males. Also, 73(8%) of these students got admitted through Direct Entry (DE), 307 (35%) through Remedial (REM) and 506 (57%) through the Unified Tertiary Matriculation Examination (UTME). As of the time of collecting the data for this study in 2012, there were ten difference courses that were being offered by students within the Faculty of Science, University of Ilorin, Nigeria. Table 1 presents the distribution of all the 886 students in this study across the ten departments in the faculty according to gender. The academic performances of a student in various courses offered in a session are recorded in percentage scores with possible marks obtainable by the student ranged between 0% and 100%. These percentage scores were converted to weighted grade point (WGP) which were thereafter converted to grade point average (the term used for student's academic performance point at the end of their first year in the university) or cumulative grade point average (the term used for student's academic performance point at the end of their second year and beyond in the university). In other words, the class of degree of a student at the end of each session is determined based on the GPA or CGPA point obtained by the student at the end of that session. The performance of students during the first session of the programme is recorded as the GPA which is a function of courses' credit units and grade points. For two or more sessions, the performance of student is recorded as the CGPA.

Table 1: Table showing the distribution of students by gender across the ten Departments in the Faculty of Science University of Ilorin.

| DEPARTMENTS          | MALE            | FEMALE           | TOTAL             |
|----------------------|-----------------|------------------|-------------------|
| Biochemistry         | 67              | 50               | 117               |
| Chemistry            | 57              | 49               | 106               |
| Geology              | 110             | 32               | 142               |
| Industrial chemistry | 26              | 30               | 56                |
| Mathematics          | 37              | 22               | 59                |
| Microbiology         | 39              | 51               | 90                |
| Physics              | 56              | 12               | 68                |
| Plant biology        | 28              | 33               | 61                |
| Statistics           | 102             | 38               | 140               |
| Zoology              | 29              | 18               | 47                |
| <b>TOTAL</b>         | <b>551(62%)</b> | <b>335 (38%)</b> | <b>886 (100%)</b> |

The distribution of the range of CPA or CGPA points obtainable by students and their respective classes of degrees as approved by National University Commission (NUC), the body saddled with the responsibility of regulating University education in Nigeria, is presented in Table 2. Any student that earn a GPA or CGPA point between 0.00 and 0.99 would be withdrawn from the programme or be made to probate (repeat the academic level) depending on whether the student is in his/her first year or second year and higher of his academic programme respectively.

Table 2: Table of possible GPAs or CGPAs that are obtainable by students at the end of each academic session till graduation and their associated classes of degree as approved by NUC for Nigeria University system.

| <b>Obtainable GPA or CGPA</b> | <b>Class of degree</b>                                  |
|-------------------------------|---------------------------------------------------------|
| 4.50 - 5.00                   | First class (honours) -1st Class                        |
| 3.50 - 4.49                   | Second class (honours) upper division - 2nd class upper |
| 2.40 - 3.49                   | Second class (honours) lower division - 2nd class lower |
| 1.50 - 2.39                   | Third class (honours) - 3rd class                       |
| 1.00 - 1.49                   | Pass                                                    |
| 0.00 - 0.99                   | Fail                                                    |

The following possible states of academic performance are true about the performances of students in the first and final years of their study in the university. First, it is possible for some students to maintain the class of degrees they earned in their first year till graduation (e.g. being 2nd class upper at 100 level to being 2nd class upper at 400 level). Another possibility is for students to improve on their initial GPA in their first year by the time they graduate (e.g. being a 3rd class at 100 level to being a 2nd class lower at 400 level). The last possibility

refers to students that dropped in academic performances at the end of their studies from the class of degrees they have in their first year in the university (e.g. . being a 2<sup>nd</sup> class upper at 100 level to being a 2<sup>nd</sup> class lower at 400 level).

**2.2. Methodology.** The variations in the academic performances of students at the end of their academic program as measured by their CGPAs are caused by a number of factors. Given the available data collected for this study, these factors include students' gender, mode of entry into the university, and the initial GPAs of students at the end of their first year in the university. The influence of these factors on the final academic performances of the students at graduation (final CGPA) in the university was determined by fitting multiple regression model (Chatterjee and Hadi, 2006) of the form

$$(1) \text{ CGPA}_i = \beta_{0i} + \beta_{1i}\text{Gender}(\text{female}_i) + \beta_{2i}\text{UTME}_i + \beta_{3i}\text{REM}_i + \beta_{4i}\text{GPA}_i + \beta_i$$

on the data.

In regression model (1), the categorical predictor, gender was coded 0 and 1 for male and female students respectively indicating that male group was made the reference category. Two dummy variables were created from students' mode of entry into the university with UTME and REM coded 1 while DE was the reference category and coded 0.

To establish agreement between the initial classes of degrees of students at the end of their first year in the university measured by their GPAs and their final classes of degrees they obtained at the end of their study equally measured by their CGPAs, a measure of agreement using the Kappa statistic was employed (Scott, 1995; Banergee et al., 1999; Lawal, 2003; Dou, et al, 2006).

The Kappa statistic is a correlation-like coefficient that measures the pairwise agreement between two raters in order to determine whether the observed agreement is just obtained by chance or not (Donner and Eliazziw, 1992). This concept was extended by Fleiss et al. (1981) to develop a weighted Kappa statistic to assess the ordinal scale degrees of agreement or disagreement.

Generally, two possible uses of kappa are i.) to test raters' independence, that is, as a test statistic for testing the null hypothesis that there is no agreement between the two raters than might occur by chance given random guessing and ii.) to quantify the level of agreement (effect-size measure), which is of more concern in this work.

For any typical square  $r \times c$  contingency table ( $with r = c$ ) as given by Table 3 (for  $r = c = 5$ ), the Kappa statistic  $k_a$  is defined as:

$$(2) \quad k_a = (\pi_0 - \pi_e) / (1 - \pi_e)$$

where;  $\pi_0 = \sum_{i=1}^r \pi_{ii}$  with  $\pi_{ii} = \frac{n_{ii}}{n_{..}}$ ;  $\pi_e = \frac{1}{n_{..}^2} \sum_{i=1}^r \sum_{j=1}^c n_{i.} n_{.j}$ ;  $n_{..} = \sum_{i=1}^r \sum_{j=1}^c n_{ij}$ .

Table 3: A typical  $5 \times 5$  contingency table used for the computation of Kappa coefficients for raters agreement between two independent ratters (Initial and Final classes of degrees obtained by students).

| Classes of Degree                 |                 | Final Class of Degree (j) |                |                |                 |          | Total    |
|-----------------------------------|-----------------|---------------------------|----------------|----------------|-----------------|----------|----------|
|                                   |                 | 1 <sup>st</sup>           | 2 <sup>1</sup> | 2 <sup>2</sup> | 3 <sup>rd</sup> | Pass     |          |
| Initial<br>Class of<br>Degree (i) | 1 <sup>st</sup> | $n_{11}$                  | $n_{12}$       | $n_{13}$       | $n_{14}$        | $n_{15}$ | $n_{1.}$ |
|                                   | 2 <sup>1</sup>  | $n_{21}$                  | $n_{22}$       | $n_{23}$       | $n_{24}$        | $n_{25}$ | $n_{2.}$ |
|                                   | 2 <sup>2</sup>  | $n_{31}$                  | $n_{32}$       | $n_{33}$       | $n_{34}$        | $n_{35}$ | $n_{3.}$ |
|                                   | 3 <sup>rd</sup> | $n_{41}$                  | $n_{42}$       | $n_{43}$       | $n_{44}$        | $n_{45}$ | $n_{4.}$ |
|                                   | Pass            | $n_{51}$                  | $n_{52}$       | $n_{53}$       | $n_{54}$        | $n_{55}$ | $n_{5.}$ |
| Total                             |                 | $n_{.1}$                  | $n_{.2}$       | $n_{.3}$       | $n_{.4}$        | $n_{.5}$ | $n_{..}$ |

Table 4: Table of the interpretation of the estimates of the Kappa Statistic  $k_a$ .

| Interval of Kappa Estimates | Strength of agreement      |
|-----------------------------|----------------------------|
| < 0.00                      | Less than chance agreement |
| 0.01 – 0.20                 | Slight agreement           |
| 0.21 – 0.40                 | Fair                       |
| 0.41 – 0.60                 | Moderate                   |
| 0.61 – 0.80                 | Substantial agreement      |
| 0.81 – 1.00                 | Almost perfect             |

However, different people have different interpretations as to what is a good level of agreement using the computed Kappa statistic,  $k_a$ . Traditionally, values of  $k_a$  between  $-1$  and  $+1$  are used to interpret the inter-rater reliability agreement between two raters (McHugh, 2012). However, interpretations of values of  $k_a$  between 0 and 1 has been a popular choice in the literature (Altman, 1991; Viera, and Garrett, 2005). To this end, Table 4 presents the interpretations of values of  $k_a$  as reported by Altman (1991) and Viera and Garrett (2005) for values of  $k_a$  in the range of 0 to 1. With these interpretations, the values of  $k_a = 0.00$  and 1.00 indicate poor agreement (agreement just by chance) and perfect agreement respectively.

Finally, based on the observed counts in the contingency Table 3, we determine the proportions of students that

- i.) dropped from their initial class of degrees ( $p_1$ ),
- ii.) maintained their initial classes of degrees ( $p_2$ ) or
- iii.) improved on their initial classes of degrees they started with ( $p_3$ ) as follows:

$$(3) \quad p_1 = \frac{1}{n_{..}} \sum_{i=1}^4 \sum_{j=1}^5 n_{ij}, \text{ for } i < j, i = 1, 2, 3, 4; j = 1, 2, 3, 4, 5$$

$$(4) \quad p_2 = \frac{1}{n_{..}} \sum_{i=1}^5 \sum_{j=1}^5 n_{ij}, \text{ for } i = j, i, j = 1, 2, 3, 4, 5$$

$$(5) \quad p_3 = \frac{1}{n_{..}} \sum_{i=1}^5 \sum_{j=1}^4 n_{ij}, \text{ for } i > j, i = 1, 2, 3, 4, 5; j = 1, 2, 3, 4$$

Thus,  $p_1$ ,  $p_2$  and  $p_3$  are computed by taken the sum of counts above the main diagonal entries, along the main diagonal entries and below the main diagonal entries in Table 3 respectively over the total sample. All data analyses in this work were performed using SPSS 17.0 software. Additional data management was performed using Microsoft excel package.

### 3. ANALYSIS AND RESULTS

Analysis of the data collected from the ten Departments in the Faculty of science, University of Ilorin on the performances of students at the end of their first and final academic sessions were presented in this section. Results from these analyses based on data collected on each department and from the combined analyses using all the data sets are also presented.

The summary of the academic performances of students in the ten Departments at the end of their first and final years in the University are presented in Table 5. The results in Table 5 are on proportion ( $p_1$ ) of students whose classes of degrees they finally graduated with at the end of their studies, for each of the ten programs, dropped from what they had at their first year in the University. Similarly, the proportion of students that maintained the classes of degrees they had during their first year by the time they graduated ( $p_2$ ) and the proportion of those that improved on the classes of degrees they had at their first year in the University by time they graduated ( $p_3$ ) are equally reported in Table 5.

In order to have a quick overview of the overall proportion of performances of students during their first and final academic sessions in the University proportions of performances ( $p_1, p_2$  and  $p_3$ ) of students in all the courses combined were equally reported in Table 5.

Finally, to be able to examine the impacts of gender on the performances of students across the ten Departments in the Faculty of Science of the University, the proportions of performances ( $p_1, p_2$  and  $p_3$ ) of students were equally reported for males and female students separately as shown in Table 5.

The bar charts of all the results in Table 5 are provided by Fig 1 in order to have a clear understanding of the different proportions of academic performances of students in all the ten courses offered at the Faculty of Science, University of Ilorin, Nigeria. The bar charts of the proportion of performances of all the 886 students in all the ten courses combined were also provided as shown in Fig 1.

Table 5: Table showing the proportion of students that: i. dropped from their initial class of degrees ( $p_1$ ), ii. maintained their initial classes of degrees ( $p_2$ ) and iii. improved on their initial classes of degrees they started with ( $p_3$ ) at the end of

their studies across all the ten programs in the Faculty of Science, University of Ilorin, Nigeria for the study periods from 2008 to 2012. These three proportions as they were observed by gender are equally reported in the table.

| Department           | Gender                       | $p_1$<br>(dropped) | $p_2$<br>(maintained) | $p_3$<br>(improved) |
|----------------------|------------------------------|--------------------|-----------------------|---------------------|
| Plant Biology        | Overall (both male & female) | 0.0328             | 0.4098                | 0.5574              |
|                      | Male                         | -                  | 0.3636                | 0.6364              |
|                      | Female                       | 0.0714             | 0.4643                | 0.4643              |
| Statistics           | Overall (both male & female) | 0.2000             | 0.6571                | 0.1429              |
|                      | Male                         | 0.1961             | 0.6863                | 0.1176              |
|                      | Female                       | 0.2106             | 0.5789                | 0.2105              |
| Geology              | Overall (both male & female) | 0.0505             | 0.5775                | 0.3720              |
|                      | Male                         | 0.0272             | 0.6364                | 0.3364              |
|                      | Female                       | 0.0627             | 0.3750                | 0.5623              |
| Chemistry            | Overall (both male & female) | 0.0189             | 0.4245                | 0.5566              |
|                      | Male                         | 0.0350             | 0.5439                | 0.4211              |
|                      | Female                       | -                  | 0.2857                | 0.7143              |
| Physics              | Overall (both male & female) | 0.1146             | 0.4589                | 0.4265              |
|                      | Male                         | 0.1250             | 0.4821                | 0.3929              |
|                      | Female                       | 0.0834             | 0.3333                | 0.5833              |
| Microbiology         | Overall (both male & female) | 0.0223             | 0.3444                | 0.6333              |
|                      | Male                         | 0.0516             | 0.4103                | 0.5381              |
|                      | Female                       | -                  | 0.2941                | 0.7059              |
| Industrial Chemistry | Overall (both male & female) | -                  | 0.4737                | 0.5263              |
|                      | Male                         | -                  | 0.5185                | 0.4815              |
|                      | Female                       | -                  | 0.4333                | 0.5667              |
| Biochemistry         | Overall (both male & female) | 0.0256             | 0.5812                | 0.3932              |
|                      | Male                         | 0.0447             | 0.5075                | 0.4478              |
|                      | Female                       | -                  | 0.6800                | 0.3200              |
| Mathematics          | Overall (both male & female) | 0.1186             | 0.6441                | 0.2373              |
|                      | Male                         | 0.1352             | 0.7297                | 0.1351              |
|                      | Female                       | 0.0909             | 0.500                 | 0.4091              |
| Zoology              | Overall (both male & female) | 0.1021             | 0.5745                | 0.3234              |
|                      | Male                         | 0.0556             | 0.6111                | 0.3333              |
|                      | Female                       | -                  | 0.5517                | 0.4483              |
| All courses combined | Overall (both male & female) | 0.0654             | 0.5260                | 0.4086              |
|                      | Male                         | 0.0799             | 0.5771                | 0.3430              |
|                      | Female                       | 0.0418             | 0.4418                | 0.5164              |

For a quick overview of the proportions of performances  $p_1$ ,  $p_2$  and  $p_3$  presented in Table 5, we provide the bar charts of these proportions (in %) for each of the

ten courses offered by the students in the Faculty of Science, University of Ilorin, Nigeria as well as bar charts of students' performances for all the 886 students in all the ten courses combined as shown by Fig 1.

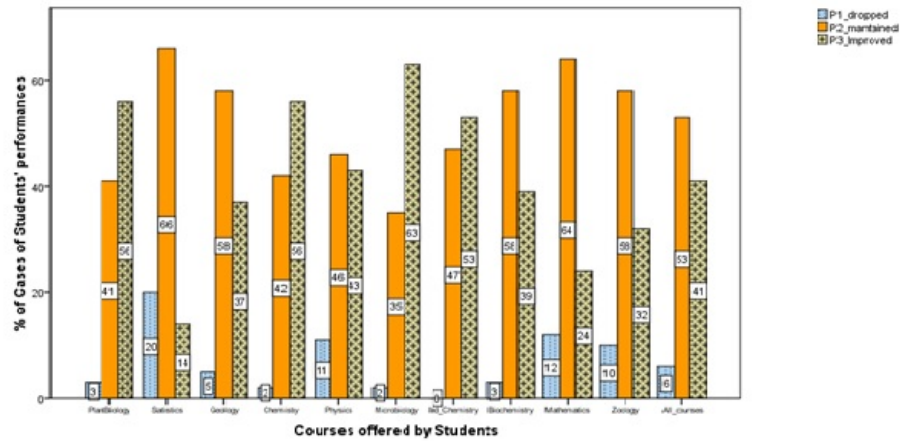


Fig 1: Bar charts showing the percentages of number of students that dropped from their initial class of degrees ( $p_1$ ), those that maintained their initial classes of degrees ( $p_2$ ) and those that improved on their initial classes of degrees they started with ( $p_3$ ) at the end of their studies across all the ten programs in the Faculty of Science, University of Ilorin, Nigeria for the study periods from 2008 to 2012. The bar charts of overall performances of all the 886 students in all the ten courses in the faculty combined are equally plotted.

In term of the observed numbers of students that ended up with different classes of degrees in their various disciplines in the Faculty, the confusion matrix in Table 6 presents the distribution of the classes of degrees obtained by the 61 students that graduated with B.Sc. Plant Biology cross-classified by their initial classes of degrees they had at the end of their first year in the University is presented by the confusion matrix in Table 6.

Table 6: The confusion matrix of the distribution of students in B.Sc. Plant Biology program at the University of Ilorin, Nigeria by their initial and final classes of degrees they had at the end of their first and final years in the University respectively.

| Classes of Degree                 |                 | Class of Degree (j) |                |                |                 |      | Total |
|-----------------------------------|-----------------|---------------------|----------------|----------------|-----------------|------|-------|
|                                   |                 | 1 <sup>st</sup>     | 2 <sup>1</sup> | 2 <sup>2</sup> | 3 <sup>rd</sup> | Pass |       |
| Initial<br>Class of<br>Degree (i) | 1 <sup>st</sup> | 0                   | 0              | 0              | 0               | 0    | 0     |
|                                   | 2 <sup>1</sup>  | 0                   | 4              | 1              | 0               | 0    | 5     |
|                                   | 2 <sup>2</sup>  | 0                   | 8              | 15             | 1               | 0    | 24    |
|                                   | 3 <sup>rd</sup> | 0                   | 1              | 23             | 6               | 0    | 30    |
|                                   | Pass            | 0                   | 0              | 0              | 2               | 0    | 2     |
| Total                             |                 | 2                   | 0              | 13             | 39              | 9    | 0     |

Table 7: Table of confusion matrices showing the distributions of 140, 142, 106, 68 and 90 students in the B.Sc. Statistics, Geology, Chemistry, Physics and Microbiology programs respectively at the University of Ilorin, Nigeria cross-classified by their initial and final classes of degrees they had at the end of their first and final years in the University respectively.

| B.Sc. Statistics                  |                 |                           |                |                |                 |      |       |
|-----------------------------------|-----------------|---------------------------|----------------|----------------|-----------------|------|-------|
| Classes of Degree                 |                 | Final Class of Degree (j) |                |                |                 |      | Total |
|                                   |                 | 1 <sup>st</sup>           | 2 <sup>1</sup> | 2 <sup>2</sup> | 3 <sup>rd</sup> | Pass |       |
| Initial<br>Class of<br>Degree (i) | 1 <sup>st</sup> | 2                         | 3              | 0              | 0               | 0    | 5     |
|                                   | 2 <sup>1</sup>  | 0                         | 23             | 10             | 0               | 0    | 33    |
|                                   | 2 <sup>2</sup>  | 0                         | 4              | 37             | 6               | 0    | 47    |
|                                   | 3 <sup>rd</sup> | 0                         | 0              | 14             | 28              | 9    | 51    |
|                                   | Pass            | 0                         | 0              | 0              | 2               | 2    | 4     |
| Total                             |                 | 2                         | 30             | 61             | 36              | 11   | 140   |

| <b>B.Sc. Geology</b>              |          |                                  |       |       |          |      |              |
|-----------------------------------|----------|----------------------------------|-------|-------|----------|------|--------------|
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 0                                | 2     | 1     | 0        | 0    | 3            |
|                                   | $2^2$    | 0                                | 8     | 35    | 2        | 0    | 45           |
|                                   | $3^{rd}$ | 0                                | 0     | 30    | 36       | 2    | 68           |
|                                   | Pass     | 0                                | 0     | 0     | 17       | 9    | 26           |
| Total                             |          | 0                                | 10    | 66    | 55       | 11   | 142          |
| <b>B.Sc. Chemistry</b>            |          |                                  |       |       |          |      |              |
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 2                                | 10    | 0     | 0        | 0    | 12           |
|                                   | $2^2$    | 0                                | 22    | 21    | 1        | 0    | 44           |
|                                   | $3^{rd}$ | 0                                | 0     | 29    | 13       | 1    | 43           |
|                                   | Pass     | 0                                | 0     | 0     | 6        | 1    | 7            |
| Total                             |          | 2                                | 32    | 50    | 20       | 2    | 106          |
| <b>B.Sc. Physics</b>              |          |                                  |       |       |          |      |              |
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 1                                | 4     | 0     | 0        | 0    | 5            |
|                                   | $2^2$    | 0                                | 6     | 11    | 2        | 0    | 19           |
|                                   | $3^{rd}$ | 0                                | 0     | 17    | 14       | 6    | 37           |
|                                   | Pass     | 0                                | 0     | 2     | 3        | 2    | 7            |
| Total                             |          | 1                                | 10    | 30    | 19       | 8    | 68           |
| <b>B.Sc. Microbiology</b>         |          |                                  |       |       |          |      |              |
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 3                                | 11    | 2     | 0        | 0    | 16           |
|                                   | $2^2$    | 0                                | 25    | 17    | 0        | 0    | 42           |
|                                   | $3^{rd}$ | 0                                | 5     | 24    | 3        | 0    | 32           |
|                                   | Pass     | 0                                | 0     | 0     | 0        | 0    | 0            |
| Total                             |          | 3                                | 41    | 43    | 3        | 0    | 90           |

Table 8: Table of confusion matrices showing the distributions of 56, 117, 59 and 47 students in the B.Sc. Industrial Chemistry, Biochemistry, Mathematics and Zoology programs respectively at the University of Ilorin, Nigeria cross-classified by their initial and final classes of degrees they had at the end of their first and final years in the University respectively. The distribution of all the 886 students in all the ten programs in the Faculty of Science cross-classified by their initial and final classes of degrees they had at the end of their first and final years respectively is equally reported in the table.

| <b>B.Sc. Industrial Chemistry</b> |          |                                  |       |       |          |      |              |
|-----------------------------------|----------|----------------------------------|-------|-------|----------|------|--------------|
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 1                                | 3     | 0     | 0        | 0    | 4            |
|                                   | $2^2$    | 0                                | 10    | 12    | 0        | 0    | 22           |
|                                   | $3^{rd}$ | 0                                | 0     | 17    | 11       | 0    | 28           |
|                                   | Pass     | 0                                | 0     | 0     | 1        | 1    | 2            |
| Total                             |          | 1                                | 13    | 29    | 12       | 1    | 56           |
| <b>B.Sc. Biochemistry</b>         |          |                                  |       |       |          |      |              |
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 0                                | 0     | 0     | 0        | 0    | 0            |
|                                   | $2^1$    | 2                                | 40    | 3     | 0        | 0    | 45           |
|                                   | $2^2$    | 0                                | 38    | 14    | 0        | 0    | 52           |
|                                   | $3^{rd}$ | 0                                | 0     | 5     | 14       | 0    | 19           |
|                                   | Pass     | 0                                | 0     | 0     | 1        | 0    | 1            |
| Total                             |          | 2                                | 78    | 22    | 15       | 0    | 117          |
| <b>B.Sc. Mathematics</b>          |          |                                  |       |       |          |      |              |
| <b>Classes of Degree</b>          |          | <b>Final Class of Degree (j)</b> |       |       |          |      | <b>Total</b> |
|                                   |          | $1^{st}$                         | $2^1$ | $2^2$ | $3^{rd}$ | Pass |              |
| Initial<br>Class of<br>Degree (i) | $1^{st}$ | 3                                | 2     | 0     | 0        | 0    | 5            |
|                                   | $2^1$    | 2                                | 11    | 2     | 0        | 0    | 15           |
|                                   | $2^2$    | 0                                | 5     | 19    | 3        | 0    | 27           |
|                                   | $3^{rd}$ | 0                                | 0     | 7     | 5        | 0    | 12           |
|                                   | Pass     | 0                                | 0     | 0     | 0        | 0    | 0            |
| Total                             |          | 5                                | 18    | 28    | 8        | 0    | 59           |

| <b>B.Sc. Zoology</b>              |                       |                                  |                      |                      |                       |      |              |
|-----------------------------------|-----------------------|----------------------------------|----------------------|----------------------|-----------------------|------|--------------|
| <b>Classes of Degree</b>          |                       | <b>Final Class of Degree (j)</b> |                      |                      |                       |      | <b>Total</b> |
|                                   |                       | <i>1<sup>st</sup></i>            | <i>2<sup>1</sup></i> | <i>2<sup>2</sup></i> | <i>3<sup>rd</sup></i> | Pass |              |
| Initial<br>Class of<br>Degree (i) | <i>1<sup>st</sup></i> | 0                                | 0                    | 0                    | 0                     | 0    | 0            |
|                                   | <i>2<sup>1</sup></i>  | 0                                | 7                    | 0                    | 0                     | 0    | 7            |
|                                   | <i>2<sup>2</sup></i>  | 0                                | 10                   | 21                   | 1                     | 0    | 32           |
|                                   | <i>3<sup>rd</sup></i> | 0                                | 0                    | 8                    | 0                     | 0    | 8            |
|                                   | Pass                  | 0                                | 0                    | 0                    | 0                     | 0    | 0            |
| Total                             |                       | 0                                | 17                   | 29                   | 1                     | 0    | 47           |
| <b>All The Ten Programs</b>       |                       |                                  |                      |                      |                       |      |              |
| <b>Classes of Degree</b>          |                       | <b>Final Class of Degree (j)</b> |                      |                      |                       |      | <b>Total</b> |
|                                   |                       | <i>1<sup>st</sup></i>            | <i>2<sup>1</sup></i> | <i>2<sup>2</sup></i> | <i>3<sup>rd</sup></i> | Pass |              |
| Initial<br>Class of<br>Degree (i) | <i>1<sup>st</sup></i> | 5                                | 5                    | 0                    | 0                     | 0    | 10           |
|                                   | <i>2<sup>1</sup></i>  | 11                               | 115                  | 19                   | 0                     | 0    | 145          |
|                                   | <i>2<sup>2</sup></i>  | 0                                | 136                  | 201                  | 16                    | 0    | 353          |
|                                   | <i>3<sup>rd</sup></i> | 0                                | 6                    | 175                  | 130                   | 18   | 329          |
|                                   | Pass                  | 0                                | 0                    | 2                    | 32                    | 15   | 49           |
| Total                             |                       | 16                               | 262                  | 397                  | 178                   | 33   | 886          |

Similarly, the distribution of the classes of degrees obtained by 140, 142, 106, 68 and 90 students that graduated with B.Sc. Statistics, Geology, Chemistry, Physics and Microbiology respectively cross-classified by their classes of degrees they had at the end of their first and final years in the University is presented by the confusion matrices in Table 7. Also, the cross-classification of academic performances of 56, 117, 59 and 47 students that graduated with B.Sc. Industrial Chemistry, Biochemistry, Mathematics and Zoology respectively cross-classified by their classes of degrees they had at the end of their first year in the University is presented by the confusion matrices in Table 8. Finally, the distribution of the classes of degrees obtained by all the 886 students in the ten academic programs offered in the Faculty combined at the end of their studies cross-classified by their classes of degrees they had at the end of their first year in the University is equally presented by the confusion matrices in Table 8.

It can be observed from the data in Table 6 for the 61 graduates of Plant Biology that a total of 34 (56%) students improved on their initial classes of degrees they started with (entries in bold pink colour). Whereas, 25 (41%) students maintained their initial classes of degrees till graduation (main diagonal entries) and while only 2 (3%) students dropped from their classes of degrees they started with at graduation (entries in bold red colour), thus, confirming the results presented in Table 5. To further examine the association between the initial and final classes of academic performance of students at the end of their first and final years in the University, the Kappa statistics were computed separately for all the ten programs offered by students in the Faculty of Science, University of Ilorin using the

information provided in Tables 6, 7 and 8. The results of the Kappa inter-rater agreement using statistic (2) are presented in Table 9 where reasonable agreement can be observed between the students' initial and final classes of degrees they had at the end of their first and final years of study in the University in vertically all the courses of study offered. This result was supported by the results of the Chi-square test of association in which the p-values for each course of study and all the courses combined were significant ( $p < 0.05$ ). However, evidence of lack of association was only shown in three of all the cases for gender (Plant-Biology - male, Physics - female and Zoology - female).

Finally, in order to measure the impacts of students' gender, model of entry into the University and the initial GPAs of students at the end of their first year on their final academic performances as measured by their final CGPAs, the linear regression model (1) was fitted to the data using the final CGPAs as response variable. The results are presented by Table 10.

In fitting the linear regression model (1), a cross validation approach was employed by dividing the entire 886 sample size in the data into 80% (709) training set and 20% (177) test set according to scheme adopted elsewhere (Yahya, 2009; Yahya, 2012; Yahya et al., 2014). The regression model was fitted to the training set and the fitted model was used to predict the CGPA scores in the test set. This was done to ascertain the stability and efficiency of the fitted model so that the final CGPA of any student can be predicted give the information on the predictors (Yahya et al., 2011; Hapfelmeier et al., 2012).

The goodness of the fitted model was determined by plotting the box plots of the residuals of the fitted model using the training and test data sets. The boxplots of these two residuals are provided by Fig 2. It can be observed from the box plots that the residual of the test data are relatively more stable (less variable) than that of the training data showing that the fitted model is quite efficient.

Table 9: Table of results of inter-rater agreement measures of Kappa statistic and the Chi-square test of association between the classes of degrees obtained by students at the end of their first and final years in the University in ten courses of study in the Faculty of Science, University of Ilorin. These results were reported first irrespective of gender and second by gender. The overall performances of students based on these test measures over the three modes of gaining admission into the University were equally reported.

| Department           | Category | Kappa ( $k_a$ ) | Chi-square ( $\chi^2$ ) | p-value  |
|----------------------|----------|-----------------|-------------------------|----------|
| Statistics           | Overall  | 0.5149          | 183.013                 | ¡ 0.0001 |
|                      | Female   | 0.3845          | 25.505                  | 0.0020   |
|                      | Male     | 0.5587          | 155.755                 | ¡ 0.0001 |
| Plant-Biology        | Overall  | 0.0683          | 31.213                  | ¡ 0.0001 |
|                      | Female   | 0.1053          | 29.176                  | ¡ 0.0001 |
|                      | Male     | 0.1159          | 7.144                   | *0.1280  |
| Geology              | Overall  | 0.3516          | 104.001                 | ¡ 0.0001 |
|                      | Female   | -0.0457         | 14.640                  | 0.0060   |
|                      | Male     | 0.4496          | 97.272                  | ¡ 0.0001 |
| Chemistry            | Overall  | 0.1686          | 95.432                  | ¡ 0.0001 |
|                      | Female   | -0.0130         | 50.509                  | ¡ 0.0001 |
|                      | Male     | -0.3464         | 55.572                  | ¡ 0.0001 |
| Physics              | Overall  | 0.2247          | 51.120                  | ¡ 0.0001 |
|                      | Female   | 0.1027          | 1.726                   | *0.7860  |
|                      | Male     | 0.2563          | 45.582                  | ¡ 0.0001 |
| Microbiology         | Overall  | 0.0418          | 38.893                  | ¡ 0.0001 |
|                      | Female   | 0.0160          | 17.757                  | 0.0010   |
|                      | Male     | 0.0800          | 17.430                  | 0.0080   |
| Industrial Chemistry | Overall  | 0.1633          | 71.403                  | ¡ 0.0001 |
|                      | Female   | 0.1583          | 20.614                  | ¡ 0.0001 |
|                      | Male     | 0.2515          | 38.025                  | ¡ 0.0001 |
| Biochemistry         | Overall  | 0.3448          | 99.557                  | ¡ 0.0001 |
|                      | Female   | 0.5263          | 48.631                  | ¡ 0.0001 |
|                      | Male     | 0.1698          | 50.013                  | ¡ 0.0001 |
| Mathematics          | Overall  | -0.3954         | 52.647                  | ¡ 0.0001 |
|                      | Female   | 0.2220          | 30.341                  | ¡ 0.0001 |
|                      | Male     | 0.6063          | 44.359                  | ¡ 0.0001 |
| Zoology              | Overall  | 0.2075          | 18.341                  | ¡ 0.0001 |
|                      | Female   | 0.0667          | 4.723                   | *0.3170  |
|                      | Male     | 0.2352          | 12.426                  | 0.0140   |
| Combined             | Overall  | 0.3192          | 775.034                 | ¡ 0.0001 |
|                      | Female   | 0.1930          | 532.221                 | ¡ 0.0001 |
|                      | Male     | 0.3960          | 525.290                 | ¡ 0.0001 |
| Mode of entry        | DE       | 0.4910          | 73.935                  | ¡ 0.0001 |
|                      | Remedial | 0.3980          | 272.804                 | ¡ 0.0001 |
|                      | UTME     | 0.2252          | 464.456                 | ¡ 0.0001 |

Table 10: Result of multiple linear regression modeling of students' final CG-PAs on gender, mode of entry and initial GPAs of students in all the ten academic programs in the Faculty of Science, University of Ilorin, Nigeria.

| Model      | B      | Std. Error | t-value | P-value |
|------------|--------|------------|---------|---------|
| (Constant) | 0.645  | 0.094      | 6.864   | 0.0001  |
| Gender (F) | 0.251  | 0.035      | 7.165   | 0.0001  |
| UTME       | 0.160  | 0.062      | 2.565   | 0.011   |
| REM        | -0.131 | 0.068      | -1.929  | 0.050   |
| FIRST GPA  | 0.822  | 0.023      | 35.282  | 0.0001  |

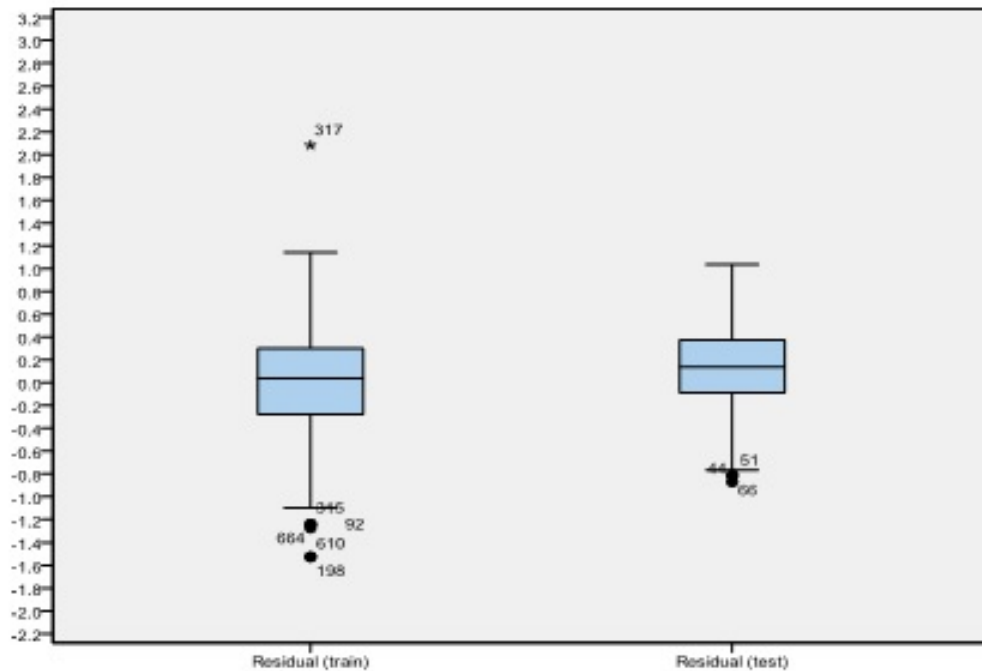


Fig 2: The Box plots of residuals of the fitted regression model for the training and test data sets.

#### 4. DISCUSSIONS

The main objective of this paper is to examine the final academic performances of students in the University based on certain information regarding their entry behaviours which include their academic performances at their first year in the University, model of getting admitted into the University and gender. However, emphasis here is more on determining the possible relationship between the initial academic performances of the students at the end of their first year in the University as measured by their GPAs and their final academic performances at

the end of their studies as measured by their CGPAs both of which are simply converted into possible classes of degrees that are obtainable within the University system as provided in Table 2.

Data on academic performances of students in ten academic fields of study as offered in the Faculty of Science, University of Ilorin, Nigeria were collected on 886 students. This study can be regarded as a longitudinal study in which the academic progresses of these 886 students were monitored till graduation.

Based on the available information on all the academic performances of 886 students in all the ten academic programs in the Faculty of Science, University of Ilorin as detained in Tables 8, it is discovered that a total of 362 ( $\approx 40\%$ ) of 886 graduates improved on the classes of degrees they had in the first year of their study. Also, 466 ( $\approx 53\%$ ) of the students maintained their classes of degrees they had in their first year till graduation while 58 ( $\approx 7\%$ ) of the students dropped from the classes of degree they started with in the first year of their study at graduation.

Specifically, out of a total of 145 students that had second class upper (21) at the end of their first year on their programs, 115 ( $\approx 79\%$ ) of them maintained this class of degree till graduation, 11 ( $\approx 8\%$ ) of them improved to first class while 19 ( $\approx 13\%$ ) of them dropped to second class lower (2<sup>2</sup>). Surprisingly, of the 10 students that started with first class in their first year, only 5 (50%) of them maintained this class of degree while the remaining 5 dropped to 21 class at graduation.

Also, of 353 students that started with 22 class from their first year in the University, 201 ( $\approx 57\%$ ) of them maintained this class of degree till graduation, 136 ( $\approx 39\%$ ) of them improved to 21 while only 16 ( $\approx 5\%$ ) of them dropped to third class (3<sup>rd</sup>) degree status at graduation.

Similarly, of the 329 students that had 3rd class degree at their first year, 130 ( $\approx 40\%$ ) of them maintained this class of degree till graduation, 181 ( $\approx 55\%$ ) improved (175 had 22 and 6 had 21), while 18 ( $\approx 5\%$ ) students from this group dropped to pass degree at graduation.

Among the 39 students that started with pass degree in their first year, 15 ( $\approx 38\%$ ) of them maintained pass degree at graduation while 34 ( $\approx 87\%$ ) of them improved to 3rd class (32 students) and 22 class (2 students).

In terms of gender, the results in Table 5 showed that about 58% and 44% of male and female students maintained the classes of degrees they had at their first year at graduation, about 34% and 52% of male and female students improved on their classes of degree at graduation while about 8% and 4% of male and female students respectively dropped from the classes of degrees they started with at graduation. The summary of this result is that female students do perform better than their male counterpart in terms of their academic improvement till graduation.

The above pattern of academic performances of students was replicated across the ten departments covered in this study except in few cases where the performances moved out of the trend. For instance, more than 40% of the students improved on the classes of degrees they had in their first year at graduation in 6 (Plant Biology, Chemistry, Physics, Microbiology, Industrial Chemistry and Biochemistry) of the 10 departments examined in this study. Specifically, more than 50% of the students in Plant Biology, Chemistry, Microbiology and Industrial Chemistry improved on their initial academic performances at graduation with no student retrogress in their academic performances till graduation in Industrial Chemistry.

The departments with the worst cases of performance were Statistics and Mathematics. In these two departments, only about 14% (Statistics) and 23% (Mathematics) of their students improved their initial academic performances at graduation with above 20% (Statistics) and (12%) dropped from their first year academic performances at graduation. Academic performances of students of Geology and Zoology Departments were apparently similar with about 37% and 32% of the students of these Departments respectively improved on their first year academic performances at graduation.

With respect to academic performances of students by gender, it can be observed from the Table 5 that female students improved significantly on their academic performances better than their male counterparts in 80% of the cases. For instance, about 70% of female students of Chemistry and Microbiology Departments improved on their first year academic performances which was significantly higher than improvements of about 42% and 54% recorded by male students from these two Departments respectively ( $p = 0.014$ ). This is an average of 22% improvement in academic performances by female over male students in the University according to the data collected. Departments where improvements in the first year academic performances of male students are apparently better than that of the females at graduation were Plant Biology (about 64%) and Biochemistry (about 45%).

Results of inter-rater agreement from Kappa statistic as presented in Table 9 clearly showed reasonable agreement between the classes of degrees of students in their first year as determined from their GPAs and final classes of degrees they had at graduation. This result was corroborated by that of the Chi-square test in the table which again showed the dependency of final classes of degrees obtained by students at graduation on their first year classes of degree as measured by their GPAs.

Finally, the impacts of some factors like mode of entry into the University, gender and of course, the initial GPAs of students in their first year on the final academic performances of students at graduation were determined through the multiple linear regression model fitted the results of which were presented in Table 10. From

the results in this table, it can be observed that female students contributed 25% improvement on their final CGPAs more than their male counterparts ( $p < 0.001$ ) while students that were admitted through UTME would have 16% improvement in their final CGPAs than their counterparts that were admitted through Direct Entry ( $p = 0.011$ ). On the other hand, students that were admitted through Direct Entry would have about 87% improvement in their final CGPAs better than their counterparts that were admitted through the Remedial mode ( $p = 0.05$ ), at any level of significant slightly higher than 5%.

More importantly, the results in Table 10 showed that initial GPAs of students at the end of their first year contributed about 82% improvement on their final CGPAs at graduation. These results clearly showed the strong impact of the initial GPAs of students in their first year on their final CGPAs at graduation. Finally, the results showed that students in the Biological Sciences improved on their initial (first year) academic performances at graduation more than their counterparts in the Physical Sciences, especially in Mathematical Science courses.

## 5. CONCLUSION

The impact of the performances of students in higher institutions of learning, especially in the University, during their first year on their final academic achievement at graduation is examined in this work. Emphasis is more on determining the relationship between the initial GPAs and final CGPAs of students at their first and final years in the University system. This was determined through a follow-up study on the performance of students in the Faculty of Science, University of Ilorin, Nigeria between 1998 and 2012.

The results from this work showed generally that about 50% of students in the University do maintained the classes of degrees they had in their first year of their program till graduation. Whereas, about 40% of the students improved on their initial classes of degrees during their first year at graduation while only about 7% of them had their academic performances dropped from what they had during their first year.

Further results indicated that female students do improved progressively on their academic program in the University better than their male counterparts.

Results from this study have provided vital information that are useful for prospective students of University regarding the need to work very hard during their first year on their academic programs since the outcome of such efforts would greatly determine their final academic performance on graduation from the University. In addition, the various results from this work would serve as useful counseling resources to stakeholders in the education sector within and outside the University system towards improving the academic performances of students in the system. This study would equally benefit the parents and guardians to be able

to put in place necessary measures that would assist at improving the academic performances of their children and wards in the University.

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