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## MATHEMATICAL INTERPRETATION OF STUDENTS' INDICES OF PERFORMANCE AND ITS IMPLICATIONS ON STUDENTS' PERFORMANCE IN THE AWARD OF CERTIFICATE AT NIGERIAN TERTIARY INSTITUTIONS


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### ABSTRACT

**INTRODUCTION:** Since the introduction of credit unit system in our tertiary institutions, indices of performance (Cumulative Grade Point Average (CGPA) has been used as an instrument of assessing students' performance from one semester to another.

**PURPOSE:** The purpose of this study is to interpret mathematically the meaning of "up to date total credits units registered" as in the definition of CGPA and its implications on students' performance in the award of certificate.

**METHODOLOGY:** The study adopted the comparative research method, the student information book (student Handbook) of various institutions were used as guide on how these institutions defined CGPA. Example was given to illustrate how calculations are done based on the definition given using a Diploma program which is a two years' program.

**RESULTS:** The up - to - date total credit units registered may include the carry - over courses which will be included in computing the CGPA of that semester. However, when this method was applied to two students who had scored the same grades, one graduating in normal two years of the program and the other one in three years of the same program due to carry - overs, their final CGPAs were not the same even though they had the same grades in all the courses (see Tables 2, 4, 6 & 7). But when "the up - to - date total credit units prescribed" was used, their final CGPAs were the same (see Tables 8 & 9).

**RECOMMENDATIONS:** Since the graduates from the various institutions do vie for the same openings on the job market even though different methods were used in computing their CGPA which determined the class of certificate they hold, it is necessary therefore, that the method of computing the CGPA be standardized in this country. This can only be achieved if explicit definition of CGPA is given.

**Keywords:** Credit Unit, GPA, CGPA, Student's Performance, Standardized



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## PUBLIC INTEREST STATEMENT

The findings of this study will guide the students of tertiary institutions with procedures of computing the CGPA on their own, the tertiary institutions who erroneously use wrong methods and the employer of labour should be able to select the right job seeker been that there is uniformity in the class of certificate awarded.

## INTRODUCTION

Students are the essential assets of every tertiary institution; without them, institutions have no value, and the quality of students these institutions produce are determined by the Cumulative Grade Point Average (CGPA) (Hasan, Ahmad & Razak, 2017; Akhter & Rahaman. 2020). CGPA therefore, shows the overall academic performance of the students in the examinations taken during their stay in the institution which is summarized in form of a grade (Jain & Bakshi, 2014; Jayanthi *et al*, 2014; Zakaria, Satari, Damahuri & Khairuddin, 2019; Akhter & Rahaman. 2020). How CGPA is computed is very important and can affect the student either positively or negatively based on the formula used. This paper is an attempt to interpret mathematically the method of computing the Cumulative Grade Point Average (CGPA) of students studying in a tertiary institution such as a Polytechnic, College of Education and University in Nigeria. CGPA has been given different interpretation by different users. It is also discovered that different users copy formats without finding the intent of the user from whom it was copied, so the meaning is lost in the process.

Tertiary Institutions in Nigeria have adopted one of a number of ways for the computation of the CGPA of its students, some of which are correct and others obviously erroneous. One example of the erroneous methods used is the situation where a student's final CGPA was less than the grade point of the lowest pass grade even though the student has passed all the courses prescribed for his/her program of study. This was as a result of the carry over of credit units that were counted twice or more which was included in the subsequent calculations especially using ordinal (simple average) method (Ezeh, 2014).

Since the graduates from the various institutions do vie for the same openings on the job market even though different methods were used in computing their CGPA which determines the class of certificate they hold, it is necessary therefore that the method of computing the CGPA be standardized in all the institutions. Therefore, this paper is an attempt towards that end.

## PURPOSE OF THE STUDY

The purpose of this study is to interpret mathematically the meaning of "up to date total credits units registered" and its implications on students' performance in the award of certificate.

## METHODOLOGY

The methodology adopted in this study is the comparative methods. The comparative research is aim at identifying differences and similarities between social entities. The population of this study are the tertiary institutions in Nigeria with special reference to Polytechnics, Colleges of Education and Universities. The students' handbooks of various institutions across Nigeria and other online articles related to computation of CGPA were used as sources of data.

## DEFINITIONS AND EXPLANATIONS OF TERMS USED

The following terms which shall be needed for the definition of CGPA are hereby explained for the sake of clarity because what some of these terms seek to define are known by different names in some institutions.

### Credit Unit (CU)

Each course is given a weight depending on the volume of work required or the extent of the syllabus. These weights are expressed in terms of whole numbers called Credit Units (CU), and are based on the number of

student/teacher contact hours per week, per semester (Okojie, 2011). For example:

One (1) Credit Unit Course = 1 hour of lecture per week per semester.

Two (2) Credit Unit Course = 2 hours of lecture per week per semester, etc

There are other definitions regarding tutorials, laboratory practical lessons, fieldwork, etc. (NCCE, 2012), (Tarabapoly, 2019 p109, B(i & ii)).

### **Credit Units Registered (CUR)**

The credit units of any course for which a student has registered to study in a given semester may be called "Credit Units Registered" and may be represented by the notation "CUR", (Tarabapoly, 2019).

### **Sum of Credit Units Registered (Sum CUR)**

The sum of the credit units of all the courses registered for by a given student in a given semester may be called "Sum of Credit Units Registered" for the semester and can be denoted by: "Sum CUR".

Let  $u_i$  be the credit units of the  $i^{\text{th}}$  course registered for by a given student in a given semester and let  $n(s)$  represent the number of courses registered for by that student in the  $s^{\text{th}}$  semester. Then  $i = 1, 2, 3, 4, \dots n(s)$ . and  $\text{Sum CUR}_s = u_1 + u_2 + u_3 + u_4 + \dots + u_{n(s)}$  (where the notation "Sum CUR<sub>s</sub>" represents the sum of the credit units of courses registered for by the student in the  $s^{\text{th}}$  semester).

For each program in a tertiary institution there are a stated minimum number of consecutive semesters at the end of which a student enrolled in that program is expected to complete his

studies. This minimum duration of the program may be extended by a further number of consecutive semesters at the end of which a student enrolled in that program may be declared to have failed the program if he had not, by then, passed all the prescribed courses. (Tarabapoly, 2019 p103; Nasarawapoly, 1999 p26, 10.6a;).

### **Cumulative Credit Units Registered (Cum CUR)**

The cumulative credit units registered by a student, up to and including, a given semester is the sum of all the Sum CUR in respect of each semester, from the first semester, up to and including, the given semester.

Let the notation "Cum CUR" represent the sum of all the Sum CUR registered in each semester by a given student from the first semester, up to and including, the  $s^{\text{th}}$  semester. Then,  $\text{Cum CUR}_s = \text{Sum CUR}_1 + \text{Sum CUR}_2 + \text{Sum CUR}_3 + \dots + \text{Sum CUR}_s$ . The Cum CUR<sub>s</sub> is also given by:  $\text{Cum CUR}_s = \text{Sum CUR}_s + \text{Cum CUR}_{(s-1)}$ . This is a more practical way of computing the Cum CUR<sub>s</sub>.

### **GRADE AND GRADE POINT**

The total mark earned by a student in a course is converted to a letter grade (usually simply called "Grade"), according to the Grading System adopted by each institution. Each letter grade is associated with a corresponding number grade called "Grade Point", (GP) (Okojie, 2011 p6, 1.4.3). There are a number of different Grading Systems in operation in institutions of higher learning in Nigeria. In this study however, the Grading System that shall be used in working out the examples is as shown below:

**Table 1: NBTE Grading System**

RANGE OF MARKS	GRADE	GRADE POINT
75% and above	A	4.00
70% to 74%	AB	3.50
65% to 69%	B	3.25
60% to 64%	BC	3.00
55% to 59%	C	2.75
50% to 54%	CD	2.50
45% to 49%	D	2.25
40% to 44%	E	2.00
0% to 39%	F	0.00

**Weighted Grade Point**

A Weighted Grade Point is a weighted score obtained by a student in a given course. It is defined as the product obtained by multiplying the credit units of that course by the grade point of the grade obtained by the student in that course. (Tarabapoly, 2019 p114, (v).

Let  $WGP_i$  be the weighted grade point earned by a student with respect to the  $i^{th}$  course registered for by him/her. If  $a_i$  is the Grade Point of the Grade obtained by the student in the  $i^{th}$  course registered for by him/her in the given semester, and  $u_i$  is the credit unit of the  $i^{th}$  course then the Weighted Grade Point earned by the student in respect of the  $i^{th}$  course is:  $WGP_i = a_i u_i$ . Suppose that a student obtained Grade B in the fourth course registered for by him/her in a particular semester and suppose also that the credit units of that course is 2; then, given that the Grade Point associated with the B grade is 3.0, the student's Weighted Grade Point in that course is:  $WGP_4 = 3.0 \times 2 = 6.0$

**Sum of Weighted Grade Points Earned**

The sum of the WGP earned by a student in all the courses registered for by him/her in a semester may be called "Sum WGP" of the student for that semester. Therefore, if the notation "Sum  $WGP_s$ " denotes the sum of all the WGP earned by the student in all the courses registered for by him/her in the  $s^{th}$  semester, then

$$\text{Sum } WGP_s = WGP_1 + WGP_2 + WGP_3 + \dots + WGP_{n(s)} = a_1 u_1 + a_2 u_2 + a_3 u_3 + \dots + a_{n(s)} u_{n(s)}. \text{ (Where } n(s) \text{ represents the number of courses}$$

which were registered for by the student in the  $s^{th}$  semester). For example if in Semester 3 a student registered for five courses then  $s = 3$  and  $n(3) = 5$ . Therefore, the Sum WGP of that student in Semester 3 is given by:

$$\text{Sum } WGP_3 = a_1 u_1 + a_2 u_2 + a_3 u_3 + a_4 u_4 + a_5 u_5$$

**Cumulative Weighted Grade Points Earned**

The Cumulative WGP, up to a given semester, is the sum of all of the Sum WGP earned by a student from the first semester up to, and including, the given semester.

Let the notation "Cum WGP" represent the sum of all the Sum WGP obtained by the student from the first semester, up to and including, the  $s^{th}$  semester. Then:

$$\text{Cum } WGP_s = \text{Sum } WGP_1 + \text{Sum } WGP_2 + \text{Sum } WGP_3 + \dots + \text{Sum } WGP_s$$

Or more practically, Cum  $WGP_s$  is also given by:  $\text{Cum } WGP_s = \text{Sum } WGP_s + \text{Cum } WGP_{(s-1)}$ .

**Credit Units Earned**

If a student is successful in the examination in a given course, then he is said to have earned the Credit units of that course irrespective of the Grade obtained by him. (Adamawapoly, 2019; Tarabapoly, 2019).

**Sum of Credit Units Earned**

Let the notation "Sum CUE" represent the sum of the credit units of courses passed by a given student in a given semester. The Sum CUE is therefore always less than or equal to the Sum CUR of that student in the given semester, the difference being

the sum of the credit units of failed courses (Sum CUF).

Let the sum of the credit units earned by a student in the  $s^{\text{th}}$  semester be represented by the notation "Sum  $CUE_s$ ", and let the notation "Sum  $CUF_s$ " represent the sum of the credit units of courses failed by the student in the  $s^{\text{th}}$  semester. Let the notation "Sum  $CUR_s$ " represent the total number of credit units registered by the student in the  $s^{\text{th}}$  semester. Then,  $\text{Sum } CUE_s = \text{Sum } CUR_s - \text{Sum } CUF_s$ . Therefore, for any semester, the Sum CUE is defined as:

1. Sum CUE = The sum of the credit units of courses passed by the student in that semester, or
2.  $\text{Sum } CUE_s = \text{Sum } CUR_s - \text{Sum } CUF_s$

We also note that, if the student completed the program in the  $x^{\text{th}}$  semester then he must have passed all the courses for which he registered in the  $(x-1)^{\text{st}}$  and  $x^{\text{th}}$  semesters. Therefore  $\text{Sum } CUF_{(x-1)} = 0$  and  $\text{Sum } CUF_x = 0$ . Therefore, for any semester, the relationships between Sum CUE, Sum CUR and Sum CUF can be summarized as follows:

1. In general,  $\text{Sum } CUE_s = \text{Sum } CUR_s - \text{Sum } CUF_s$  and in particular, if  $x$  is the ordinal number of the semester in which the student completed his/her studies, then he/she did not fail any course in the  $(x - 1)^{\text{st}}$  and the  $x^{\text{th}}$  semesters. Therefore,
2.  $\text{Sum } CUE_{(x-1)} = \text{Sum } CUR_{(x-1)}$ , and  $\text{Sum } CUE_x = \text{Sum } CUR_x$ , since  $\text{Sum } CUF_{(x-1)} = 0$ , and  $\text{Sum } CUF_x = 0$ .

### Cumulative Credit Units Earned (Cum CUE)

The Cumulative CUE is a counter indicating the total number of credit units that has been earned by a student up to any given semester in the course of his studies. Let the notation "Cum  $CUE_s$ " stand for the sum of all the Sum CUE earned by the student from the first semester up to, and including, the  $s^{\text{th}}$  semester. Then,

$\text{Cum } CUE_s = \text{Sum } CUE_1 + \text{Sum } CUE_2 + \text{Sum } CUE_3 + \dots + \text{Sum } CUE_s$   
or

$$\text{Cum } CUE_s = \text{Sum } CUE_s + \text{Cum } CUE_{(s-1)}$$

### Credit Units Prescribed (CUP)

For each program of study there are a number of courses which a student enrolled in that program must register for and obtain a pass grade in each of them in order to qualify for the award of a certificate. Such courses are called "prescribed" courses (Nile, 2017 p14 (39(1a); Tarabapoly, 2019 p119 (vii)). The courses prescribed for a given program of study are grouped according to level and semester in such a way that the courses prescribed for a particular semester are different from those prescribed for other semesters. Of the courses prescribed to be registered for the first time in a given semester a student may register for all of them or some only in accordance with certain limitations regarding the maximum work load of the student or pre-requisites, (Nassarawapoly, 1999 pp20).

### Sum of Credit Units Prescribed (Sum CUP)

Let the credit units of a prescribed course which a student is registering for the first time in the course of his/her studies be called "Credit Units Prescribed (CUP)" and let the credit Units of a prescribed course which the student is registering for again in any given semester as a carry-over be called "Credit Units Carried-over (CUC)". The courses registered for by a student in any given semester may be made up of courses which the student is registering for the first time in that semester as well as carry over courses which he is registering for again having failed them in previous semesters. The sum of the credit units of courses registered for by a student in any given semester, (Sum CUR), therefore, is equal to the sum of the credit units of prescribed courses for which he is registering for the first time in that semester, (Sum CUP), and the sum of the credit units of carry over courses which he is registering for again in that semester, (Sum CUC).

Therefore:

$$\text{Sum } CUR_s = \text{Sum } CUP_s + \text{Sum } CUC_s$$

i.e,  $\text{Sum } CUP_s = \text{Sum } CUR_s - \text{Sum } CUC_s$



In summary therefore, the relationships between Sum CUR, Sum CUP and Sum CUC are as follows:

- i. In general,  $\text{Sum CUP}_s = \text{Sum CUR}_s - \text{Sum CUC}_s$ .  
 However,
- ii.  $\text{Sum CUC}_1 = 0$ , and  $\text{Sum CUC}_2 = 0$  since the student did not register for any carry over course in his/her first two semesters. Therefore,
- iii.  $\text{Sum CUP}_1 = \text{Sum CUR}_1$  and  $\text{Sum CUP}_2 = \text{Sum CUR}_2$

**CUMULATIVE CREDIT UNITS PRESCRIBED (Cum CUP)**

The Cumulative Credit Units Prescribed (Cum CUP), up to a given semester is the sum of all the Sum CUR registered by a given student from the first semester up to, and including that semester. The credit units of each prescribed course registered for from the first semester, up to, and including the given semester are included once, and once only, in the Cum CUP of that semester despite the fact that some particular courses may have been registered for again, and perhaps again, as carry over within that period.

Let the notation "Cum CUP<sub>s</sub>" represent the sum of all the Sum CUP, from the first semester up to, and including, the s<sup>th</sup> semester. Then,  $\text{Cum CUP}_s = \text{Sum CUP}_1 + \text{Sum CUP}_2 + \text{Sum CUP}_3 + \dots + \text{Sum CUP}_s$

Or, more practically,  $\text{Cum CUP}_s = \text{Sum CUP}_s + \text{Cum CUP}_{(s-1)}$

**Relationship Between Cum CUPs and Cum CUEs**

By definition, for any given semester, the s<sup>th</sup> semester, say,  $\text{Sum CUP}_s = \text{Sum CUR}_s - \text{Sum CUC}_s$ . Therefore, since

$\text{Cum CUP}_s = \text{Sum CUP}_1 + \text{Sum CUP}_2 + \text{Sum CUP}_3 + \dots + \text{Sum CUP}_s$ , we obtain that:

$$\begin{aligned} \text{Cum CUP}_s &= (\text{Sum CUR}_1 - \text{Sum CUC}_1) + (\text{Sum CUR}_2 - \text{Sum CUC}_2) + \dots + (\text{Sum CUR}_s - \text{Sum CUC}_s) \\ &= (\text{Sum CUR}_1 + \text{Sum CUR}_2 + \text{Sum CUR}_3 + \dots + \text{Sum CUR}_s) - (\text{Sum CUC}_1 + \text{Sum CUC}_2 + \text{Sum CUC}_3 + \dots + \text{Sum CUC}_s) \\ &= \text{Cum CUR}_s - \text{Cum CUC}_s \end{aligned} \dots(i).$$

Similarly, if s is the ordinal number of any given semester then since by definition,

$$\begin{aligned} \text{Sum CUE}_s &= \text{Sum CUR}_s - \text{Sum CUC}_s, \\ \text{it can be shown that} \\ \text{Cum CUE}_s &= \text{Cum CUR}_s - \text{Cum CUC}_s \dots (ii) \end{aligned}$$

If the student completed his/her studies in the x<sup>th</sup> semester then, with regard to semester x, equations (i) and (ii) can be written as:

$$\begin{aligned} \text{Cum CUP}_x &= \text{Cum CUR}_x - \text{Cum CUC}_x \dots (i)a, \\ \text{Cum CUE}_x &= \text{Cum CUR}_x - \text{Cum CUC}_x \dots (ii)a \end{aligned}$$

Subtracting equation (ii)a from equation (i)a we obtain that,

$$\begin{aligned} \text{Cum CUP}_x - \text{Cum CUE}_x &= (\text{Cum CUR}_x - \text{Cum CUC}_x) - (\text{Cum CUR}_x - \text{Cum CUC}_x) \\ &= \text{Cum CUC}_x - \text{Cum CUC}_x \dots (iii) \end{aligned}$$

If the student passed all the courses prescribed for his/her program of study, then he/she must have registered again for all the courses he/she had previously failed and passed them all. Therefore,

$$\text{Cum CUC}_x = \text{Cum CUC}_x$$

Therefore,  $\text{Cum CUP}_x = \text{Cum CUE}_x$

This result means that the Cum CUP and the Cum CUE of a student in his/her final semester are equal. It also means that the maximum total number of credit units that a student can earn by the end of his/her studies equals the sum of the credit units of the courses prescribed for his/her program of study irrespective of the total number of credit units which he/she may have failed or registered as carry over, in the process.

**INDICES OF PERFORMANCE**

1. The Grade Point Average (GPA), which a student earns at the end of any given semester, is defined as the quotient obtained when the sum of the Weighted Grade Points (Sum WGP) earned by the student in the given semester is divided by the sum of the credit units registered, (Sum CUR) in the given semester. (Nasarawapoly, 1999 p23; Okojie, 2011; FUWukari, 2014 p38 (3a); Tarabapoly, 2019). Let the notation "GPAs" represent the GPA

of the student in the sth semester.

$$\text{Then, } GPA = \frac{\text{Sum } WGP_s}{\text{Sum } CUR_s}$$

From this definition therefore the GPA can be regarded as the "Grade Point" of the "Grade" earned by the student per credit unit registered by him/her in the given semester.

The value of the GPA ranges from zero to the Grade Point of the highest grade. The particular value of the GPA obtained by a student at the end of a given semester indicates how well he/she had performed during that semester. By comparing the value of his/her GPA for the current semester with those obtained by him/her in earlier semesters the student can advise himself/herself regarding the total number of credit units that he/she may register in the following semester, because he/she is under no compulsion to carry the heaviest load nor the lightest one since he/she has the freedom to progress at his/her own pace.

2. The Cumulative Grade Point Average (CGPA), is the quotient obtained when the up-to-date total of the Weighted Grade Points earned by a student enrolled in a program of study is divided by the up-to-date total of the credit units registered by the student" (Covenantpoly, 2006; Fedpoly, 2011; FUWukari, 2014; Jain & Bakshi, 2014; Oduwole, Shehu, Adegoke & Osondu, 2019; ABUZaria, 2020; NCCE, p20, 10.03 (i)).

The CGPA is the index used in determining the progression of a student through his/her studies. In other words, whether a student shall be permitted to continue his/her studies in the next semester on promotion or probation, or whether he/she shall be asked to withdraw from the program for performing poorly in it so far, depends on the most recent value of his/her CGPA (Nasarawapoly, 1999; Fedpoly, 2011; Tarabapoly, 2019). So Promotion, Probation and Withdrawal are defined in terms of the CGPA as follows:

### 1. Promotion

"A student whose CGPA at the end of any given period is equal to, or greater than the grade point of the lowest pass grade shall be promoted to the next semester" even though he/she may still have examinations to write in courses carried over. (Tarabapoly, 2019 p128).

### 2. Probation

"Probation is a status granted to a student whose academic performance falls below an acceptable standard" (Fedpoly, 2011; FUWukari, 2014; Tarabapoly, 2019; ABUZaria, 2020), the acceptable standard being that his/her CGPA should be at least equal to the grade point of the lowest pass grade (or a minimum grade point determined by the institution). A student whose CGPA falls below the grade point of the lowest pass grade, (or the minimum grade point determined by the institution), for the first time at the end of any given period shall be placed on probation in the next available period during which he/she is expected to raise his/her CGPA to at least the minimum acceptable. Since "probation is intended to enable weak students study at their own pace without affecting their grades, "no student on probation shall be allowed to register for more than (a stated maximum number of credit units)" (Katsinapoly 1.12.2 p67; Fedpoly. 2011).

### 3. Withdrawal

"No student shall be on probation in two or more consecutive semesters", (Fedpoly, 2011; Tarabapoly, 2019). Therefore "any student whose CGPA falls below the grade point of the lowest pass grade, (or the minimum grade point determined by the institution), at the end of any period of probation shall be asked to withdraw from the program" (NCCE, 2012).

## DATA PRESENTATION AND ANALYSIS Interpretation of the Definition of CGPA

Since the progression of a student depends on the most recent value of his/her CGPA, it is essential that the correct interpretation is given to the definition. The phrase "up-to-date total of the credit units registered", as stated in the general definition, is open to more than one interpretation. Each interpretation leads to a specific formula for the computation of the CGPA, with the result that more than one value of the CGPA may be obtained from the same set of data. Since the CGPA is the index which determines the progression of a student from one semester to the next one as well as the class of certificate with which he/she graduates, it will be agreed that any formula used for computing the CGPA must meet the following requirements:

1. The final value of the CGPA calculated with the formula in respect of any given student must be equal to, or greater than, the grade point of the least pass grade once a student has passed all the courses, irrespective of the grades obtained by him/her.
2. The total number of credit units earned by the student at the end of his/her studies should be equal to the total number of credit units prescribed for his/her program.
3. The formula must incorporate, or be based on a factor that enables meaningful comparison to be made between the graduating CGPA of, or the classes of certificates awarded to: students enrolled in the same program in the same institution, or students enrolled in a given program in one institution with those obtained by students enrolled in a similar program in other institutions, because one of the objectives of the course-unit system on which academic programs in all tertiary institutions are based is that it should be possible to compare the certificates issued by various institutions. (NCCE, 2012 p 6; Okojie, 2014).

4. The pre-graduation value of the CGPA obtained in respect of a given student at the end of a given semester should reflect his degree of performance in relation to the actual up-to-date total of the credit units of the courses prescribed for him/her up to, and including, the given semester, and not the number of credit units on offer in that semester, since:

- Each student is allowed to progress at his/her own pace (NCCE, 2012),
- It is intended that it should be possible for a student to transfer to another similar institution to continue his/her studies (Globalpoly, pp35; ABUZaria, 2020 p42).

The value of a student's CGPA at any point in his/her studies may be regarded as the "Grade Point" of the "Grade" earned by him/her per credit unit prescribed, so far, for him/her out of the total number of courses prescribed for his/her program of study. Therefore, the maximum number of credit units that can be taken into account in computing the final value of his/her CGPA should not be more than the total number of credit units prescribed for his/her program of study. This means also that in order to calculate even the pre-graduation CGPA of the student for any semester the credit units of carry over courses must not be included in the total number of credit units to be taken into account, because the purpose of asking a student to write a carry-over examination in a failed course again is to ensure that he/she has acquired, at least, the minimum knowledge or skill expected of him/her in that course and by crediting him/her with the actual grade earned by him/her in the carry over examination it is intended to imply that the index that measures his/her performance should not be affected adversely because of the carry over examinations that he/she wrote. These considerations are lost if the credit units of carry over courses are included in the computation of his/her CGPA.

No doubt, the class of the Certificate awarded a student is an



indication of the soundness of the knowledge or skill acquired by him/her by participating in the program and therefore one would normally expect that the final value of a student's CGPA should reflect this quality unequivocally. Therefore, the formula for computing the CGPA must satisfy all the criteria listed above.

### 1. Mathematical Analysis

The example is hereby given for illustration referred to as Students' **A** and **B** results as presented in the Tables below. All the students are from the Polytechnic which is a two years' program and can equally be applied to more than two years' programs.

**Table 2: The Examination Results of 'Student A'**

COURSE CODE	CU	YEAR 1		COURSE CODE	CU	YEAR 2		
		SEM 1	SEM 2			SEM 3	SEM 4	SEM 5
DIP 111	3	CD		DIP 211	3	C		
SIP 112	3	D		DIP 212	3	C		
DIP 113	3	D		DIP 213	3	D		
DIP 114	3	C		DIP 214	3	CD		
DIP 115	3	CD		DIP 215	2	D		
DIP 116	3	C		DIP 216	3	AB		
DIP 117	2	C		DIP 217	2	D		
DIP 118	2	CD		DIP 221	3		CD	
DIP 119	2	C		DIP 222	3		CD	
DIP 121	3		CD	DIP 223	3		C	
DIP 122	3		BC	DIP 224	3		C	
DIP 123	2		CD	DIP 225	2		C	
DIP 124	3		D	DIP 226	3		AB	
DIP 125	3		C	DIP 227	2		B	
DIP 126	3		CD					
DIP 127	3		C					
DIP 128	2		D					

**Table 3: Summary of credit units registered, prescribed, earned and weighted grade points of "student A"**

Summary		SEM 1	SEM 2	SEM 3	SEM 4
<b>Sum of Credit Units Registered</b>	<b>(Sum CUR)</b>	24	22	19	19
<b>Sum of Credit Units Prescribed</b>	<b>(Sum CUP)</b>	24	22	19	19
<b>Sum of Credit Units Earned</b>	<b>(Sum CUE)</b>	24	22	19	19
<b>Sum of Weighted Grade Points</b>	<b>(Sum WGP)</b>	60.50	56.75	50.25	54.00

**Table 4: The Examination Results of 'Student B'**

COURSE CODE	CU	YEAR 1		COURSE CODE	CU	YEAR 2		
		SEM 1	SEM 2			SEM 3	SEM 4	SEM 5
DIP 111	3	CD		DIP 111	3			
SIP 112	3	D		SIP 112	3			
DIP 113	3	D		DIP 113	3			
DIP 114	3	C		DIP 114	3			
DIP 115	3	CD		DIP 115	3			
DIP 116	3	F		DIP 116	3	C		
DIP 117	2	C		DIP 117	2			
DIP 118	2	CD		DIP 118	2			
DIP 119	2	C		DIP 119	2			
DIP 121	3		CD	DIP 121	3			
DIP 122	3		F	DIP 122	3		BC	
DIP 123	2		CD	DIP 123	2			
DIP 124	3		D	DIP 124	3			
DIP 125	3		C	DIP 125	3			
DIP 126	3		CD	DIP 126	3			
DIP 127	3		C	DIP 127	3			
DIP 128	2		D	DIP 128	2			
				COURSE CODE	CU	SEM 3	SEM 4	SEM 5
				DIP 211	3	C		
				DIP 212	3	C		
				DIP 213	3	D		
				DIP 214	3	CD		
				DIP 215	2	F		D
				DIP 216	3	AB		
				DIP 217	2	D		
				DIP 221	3		CD	
				DIP 222	3		CD	
				DIP 223	3		C	
				DIP 224	3		C	
				DIP 225	2		C	
				DIP 226	3		AB	
				DIP 227	2		B	

**Table 5: Summary of credit units registered, prescribed, earned and weighted grade points of "student B"**

Summary	SEM 1	SEM 2	SEM 3	SEM 4	SEM 5
<b>Sum of Credit Units Registered (Sum CUR)</b>	24	22	24	22	2
<b>Sum of Credit Units Prescribed (Sum CUP)</b>	24	22	19	19	0
<b>Sum of Credit Units Earned (Sum CUE)</b>	19	19	22	22	2
<b>Sum of Weighted Grade Points (Sum WGP)</b>	47.25	47.75	50.25	54.00	4.50

Tables 2 & 4 can be interpreted as follows:

Column 1 is for course codes, column 2 for credit unit of courses, column 3 to 6

are years of study which is divided into semesters with grades obtained in each courses for that semester. From the Tables, Student **A** graduated in the normal two years expected without carry over, while Student **B** graduated in the third year or 5<sup>th</sup> semester with carry overs and the two students had the same grades. The calculations are shown on the following Tables (6 & 7)

Interpreting Tables 6 & 7 as follows: column 1 as academic session, column 2 as semesters, column 3 calculations of GPA for current semester, column 4 is for cumulative information on previous semesters, column 5 calculations of CGPA of the current semester. Student's **A** result in table 6 shows that he registered a total of 84

credit units, which is the prescribed credit units for that program of study and pass all 84 with CGPA of 2.64. While in the other hand Student **B** in the same program registered a total of 94 at the end of 5<sup>th</sup> semester and pass 84 credit units as shown in table 7 with CGPA of 2.36 even though his performances in grades are the same as that of student **A**. Now, comparing the two results one may be tempted to say Student **B** has 10 more credit units to pass since he registered 94 and pass 84, but in the true sense of it Student **B** has registered 84 as prescribed credit units for that program. Due to carry overs he has to re-registered the failed credit units which were counted twice in the calculations.

**Table 6: Student A Performance using up to date total credits registered**

SESSION	SEM	THIS SEMESTER'S					THE PREVIOUS SEMESTER'S			THIS SEMESTER'S			
		SUM CUR	SUM CUP	SUM CUE	SUM WGP	GPA	CUM CUR	CUM CUE	CUM WGP	CUM CUR	CUM CUE	CUM WGP	CGPA
2003/2004	1	24	24	24	60.50	<b>2.52</b>	0	0	0.00	<b>24</b>	24	60.50	<b>2.52</b>
	2	22	22	22	56.75	<b>2.58</b>	24	24	60.50	<b>46</b>	46	117.25	<b>2.55</b>
2004/2005	3	19	19	19	50.25	<b>2.64</b>	46	46	117.25	<b>65</b>	65	167.50	<b>2.58</b>
	4	<b>19</b>	<b>19</b>	<b>19</b>	<b>54.00</b>	<b>2.84</b>	<b>65</b>	<b>65</b>	<b>167.50</b>	<b>84</b>	<b>84</b>	<b>221.50</b>	<b>2.64</b>

**Table 7: Student B Performance using up to date total credits registered**

SESSION	SEM	THIS SEMESTER'S					THE PREVIOUS SEMESTER'S			THIS SEMESTER'S			
		SUM CUR	SUM CUP	SUM CUE	SUM WGP	GPA	CUM CUR	CUM CUE	CUM WGP	CUM CUR	CUM CUE	CUM WGP	CGPA
2003/2004	1	24	24	19	47.25	<b>1.97</b>	0	0	0.00	<b>24</b>	19	47.25	<b>1.97</b>
	2	22	22	19	47.75	<b>2.17</b>	24	19	47.25	<b>46</b>	38	95.00	<b>2.07</b>
2004/2005	3	24	19	22	59.00	<b>2.46</b>	46	38	95.00	<b>70</b>	60	154.00	<b>2.20</b>
	4	22	19	22	63.00	<b>2.86</b>	70	60	154.00	<b>92</b>	82	217.00	<b>2.36</b>
2005/2006	5	<b>2</b>	<b>0</b>	<b>2</b>	<b>4.50</b>	<b>2.25</b>	<b>92</b>	<b>82</b>	<b>217.00</b>	<b>94</b>	<b>84</b>	<b>221.50</b>	<b>2.36</b>

Now, Tables 8 & 9 is a situation where credit units prescribed are used instead of credit units registered, the difference is that credit units prescribed are the credit units of composite courses of an academic program, while the credit units registered are all credit units of courses registered for including the carry

over courses (Mukadasi, 2013), the results shown that their CGPA are not the same as they progress but the final CGPA are the same even though Student **B** graduated in the third year and have been having the same grades with Student **A** who graduated in two years and credit units earn is equal to credit units Prescribed for the program. But

Table 6 & 7 shown that their CGPAs are same grades all through. not the same even though they had the

**Table 8: Student A Performance using up to date total Prescribed credits registered**

SESSION	SEM	THIS SEMESTER'S					THE PREVIOUS SEMESTER'S			THIS SEMESTER'S			
		SUM CUR	SUM CUP	SUM CUE	SUM WGP	GPA	CUM CUP	CUM CUE	CUM WGP	CUM CUP	CUM CUE	CUM WGP	CGPA
2003/2004	1	24	24	24	60.50	<b>2.52</b>	0	0	0.00	<b>24</b>	24	60.50	<b>2.52</b>
	2	22	22	22	56.75	<b>2.58</b>	24	24	60.50	<b>46</b>	46	117.25	<b>2.55</b>
2004/2005	3	19	19	19	50.25	<b>2.64</b>	46	46	117.25	<b>65</b>	65	167.50	<b>2.58</b>
	4	<b>19</b>	<b>19</b>	<b>19</b>	<b>54.00</b>	<b>2.84</b>	<b>65</b>	<b>65</b>	<b>167.50</b>	<b>84</b>	<b>84</b>	<b>221.50</b>	<b>2.64</b>

**Table 9: Student B Performance using up to date total Prescribed credits registered**

SESSION	SEM	THIS SEMESTER'S					THE PREVIOUS SEMESTER'S			THIS SEMESTER'S			
		SUM CUR	SUM CUP	SUM CUE	SUM WGP	GPA	CUM CUP	CUM CUE	CUM WGP	CUM CUP	CUM CUE	CUM WGP	CGPA
2003/2004	1	24	24	19	47.25	<b>1.97</b>	0	0	0.00	<b>24</b>	19	47.25	<b>1.97</b>
	2	22	22	19	47.75	<b>2.17</b>	24	19	47.25	<b>46</b>	38	95.00	<b>2.07</b>
2004/2005	3	24	19	22	59.00	<b>2.46</b>	46	38	95.00	<b>65</b>	60	154.00	<b>2.36</b>
	4	22	19	22	63.00	<b>2.86</b>	65	60	154.00	<b>84</b>	82	217.00	<b>2.58</b>
2005/2006	5	<b>2</b>	<b>0</b>	<b>2</b>	<b>4.50</b>	<b>2.25</b>	<b>84</b>	<b>82</b>	<b>217.00</b>	<b>84</b>	<b>84</b>	<b>221.50</b>	<b>2.64</b>

## RESULTS

From the results, it shows that if a student did not fail any course throughout his/her studies, then he/she will complete his/her program in four semesters as in the case of Polytechnic program. For such a student, the value of the CGPA obtained using any of these methods will be found to be the same (see tables 6 & 8). However, only very few students can be able to complete their studies without having to write carry over examinations and one cannot wait till a student has completed his studies so that his final CGPA can be calculated. The pre-graduation CGPA which determines whether a student can be promoted, withdrawn or put on probation has to be determined at the end of every semester. Therefore, including the carry over credit units in calculating CGPA means that the aim of asking the student to carry over a course is defeated, since it is aim to improved his/her performance and facilitate student's progress at own pace. The definition "up-to-date total of the credit units of the courses registered for up to

and including the given semester" in defining CGPA should mean the prescribed credit units of composite courses for the given program for that semester. While determining the progress for each semester, credit units of the carry-over courses can be included in computing GPA and for the overall performance (CGPA) where cumulative credit units are used, prescribed credit units should be used for courses cannot be counted twice.

With the understanding that the "up-to-date total of the credit units of courses registered for by the student" as stated in the definition of the CGPA given above should not include the credit units of carry over courses registered for by student, the definition of the CGPA can be rendered correctly as follows:

"The Cumulative Grade Point Average (CGPA) of a given student at the end of a given semester is the quotient obtained when the up-to-date total of the Weighted Grade Points (Cum WGP) earned by a student enrolled in a program of study is divided by the up-to-date total of the credit units of prescribed courses for which the student registered

for the first time in each of the semesters leading up-to, and including the given semester (Cum CUP)".

### **CONCLUSION**

In this paper it has been shown that the definition of the CGPA has been interpreted differently by different institutions, hence, different results are obtained (Table 6 & 8). This means that, given the same set of examination results, a student who may have failed the program in one institution, could have passed in another, and vice versa. Also the same set of examination results could earn one student a higher CLASS of certificate than another student who studied in a different institution because of the differences in the methods of computation of the CGPA. Therefore, one of the conditions for the award of certificate can be stated as:

"A student is said to have qualified for the award of a certificate if, and only if., by the end of the length of time prescribed for his/her program of study, the total number of credit units earned by him/her equals the total number of credit units prescribed for his/her program of study ". This means, by implication, that if by the length of time prescribed for his/her program of study the final value of a student's Cum CUE is less than the final value of the Cum CUP of the program, then he/she has failed.

### **RECOMMENDATIONS**

Since all these graduates from different institutions whose CGPA have been computed with different methods or formulae do contest for the same openings on the job market, there is need for uniformity in computation of CGPA. Therefore, the following recommendations are hereby made with a view to rationalizing the methods of computation of the CGPA.

1. The standards regulating bodies of education such as the NBTE, the NCCE, and the NUC should approve and give the correct interpretations of the CGPA.
2. It is hoped that the formula for the computation of the CGPA discussed in this paper which is at students'

advantage be adopted for uniformity, even though there are acceptable methods but this one is easier and simple to applied.

The paper has focused on the Polytechnics because their programs are of a shorter duration as compared to NCE or university degree programs. However, the methods discussed herein can be adapted to programs which are of a different duration such as NCE and university degree programs.

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**Danladi Ibrahim Yakoko** worked on the abstract, the Tables and its interpretations, results, conclusion and recommendations

**Ayuba Ibrahim** assisted in gathering the students' handbooks of various institutions, purpose of the study, methodology and definitions of terms.

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