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Research Article

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Plethoric Classes and Academic Performances in Cartography Among Senior Secondary Learners in Cameroon

Ernest E Nkemleke[1*], Eleno Manka'a Fube[2]

[1]*DIPES II, Higher Teacher Training College (ENS) Yaounde, University of Yaounde I; Cameroon*

[2]*Department of Geography, Higher Teacher Training College (ENS) Yaounde, University of Yaounde I, Cameroon*

[*]Corresponding author
Ernest E. Nkemleke, DIPES II, Higher Teacher Training College (ENS) Yaounde, University of Yaounde I, Cameroon.

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Abstract

Teaching and learning cartography greatly influence the standard and quality of geographic knowledge since the use of cartography tools impacts the teaching-learning process at all levels. This paper seeks to investigate the influence of plethoric classes on learners' academic performances in cartography in Cameroon. There is an observed negative effect of plethoric classes on learners' academic performances in cartography in Forms 4 and 5 in Cameroon. Empirical data from four secondary high schools in Yaounde VI Subdivision based on qualitative and quantitative methods was used for the analysis. Data collection methods were field surveys, key informant interviews and direct observations. Analyses were carried out using Microsoft Excel 2016 and SPSS 16 software. Findings revealed that Forms 4 and 5 classrooms are overcrowded with student-teacher ratio >60:1; impeding the proper teaching-learning of cartography and that teachers use the teacher-centred rather than the student-centred approach which undermines the acquisition of cartographic skills. This leads to poor results during trimestral and regional examinations. ANOVA test revealed that there was a significant difference ($p<0.05$) between learners' performances in schools with plethoric classes and schools with normal classroom student-teacher ratio. The study suggests that the splitting of plethoric classrooms into smaller tutorial groups with different time tables, stressing on group work and more practical cartographic exercises remain the appropriate approaches to teach cartography in plethoric classes.

Keywords: Cartography, Learners, Plethoric Classes, Academic Performance, Cameroon

Background

Education, in every nation, is a very crucial process and indispensable tool through which an individual's life and wellbeing are determined. This is because education is perceived as a universal investment in the lives of humans and a resource for economic benefit of every nation. Therefore, this is the reason why the government of every nation is preoccupied in providing education for every citizen (UNESCO, 2003).

Education does not take place in space but it is done in a well-structured environment with physical and material resources that facilitate the proper teaching-learning process [1]. The general specifications given for the establishment and management of material resources in secondary schools are stipulated in the laws and policies that govern every country's educational system. According to the aim of material resources like infrastructures in secondary schools seeks to augment school attendance and motivate staff in order to improve learners' academic achievement [2]. School material resources have a significant link with its users (learners and instructors) and play an important role in the attainment of the school's intended objectives and overall quality performance in national examinations. Empirical research has shown that a well-organised school, with clean and safe learning environment improve learners' achievement [3, 4]. In most public secondary schools in Cameroon, there is an observed inadequacy in infrastructural facilities such as classrooms, toilets, hostels and laboratories. This situation is, however, slightly improved in private schools and this has evident impacts on learners' performances through active classroom participation.

According to active classroom participation contributes enormously to academic success and learners' personal development in future. Also, shows that learners, who are actively involved in classroom participation, have higher satisfaction and better grasp of the lesson. This is evident in disciplines like cartography. affirms that geographical discourses in cartography in secondary schools are very significant and mark the identity of the discipline—Geography. These discourses guide learners to produce sketch and interpret maps to acquaint themselves with cartographic skills especially with the introduction of the new pedagogic approach [5-8].

The introduction of the Competency-Based Approach (CBA) in Cameroon schools has faced numerous challenges which continue to plague the implementation of this pedagogic approach.

These challenges include small classroom space, limited didactic resources, over enrolment in schools leading to overcrowding, among others. This scenario corroborates findings that dilapidated classes, plethoric classes and uncomfortable school infrastructure lead to low morale among learners and teachers [1]. This may lead to a drop in students' academic performances. In this light, there is need for effective planning of physical and material resources within a context of broad-based curriculum with more diversified and specialised programmes, organising and coordinating equipment for teaching and learning to be effective [10]. In this regard, there is a mismatch in coordinated planning and the implementation of CBA in Cameroon, which in turn does not produce the desired expectations.

Learners' academic performances in cartography in most secondary schools in Yaounde have been unsatisfactory owing to multifarious factors. It is worth noting that teaching-learning process is quite successful when the process is actively coordinated with fewer learners involved. One of the exigencies of the CBA in Cameroon secondary education is to place the teaching-learning process on a more active platform-putting putting learner at the centre of the process). This approach, it is envisaged will gradually culminate to a change from passive learning to active learning of all disciplines in the secondary school. However, plethoric classes do not seem the appropriate environment for learners to acquire knowledge in schools, notably for technical and practical subjects like cartography, which is the focus in this study.

Although existing literature should redefine, innovate and enhance educational environment and practices, unstructured teaching/learning environment still hampers teachers' teaching methods. In this regards, existing literature focuses solely on the physical characteristics and instructional techniques in teaching/learning environments neglects the resultant effects on students' academic performances [11-14]. This is why posit that there is a need for research into the interrelationship between the different dimensions of learning environments such as spaces, teaching techniques and learning outcomes. There is little or no literature pertaining to the influence of teaching/learning environment on students' academic performances in specific disciplines. The findings of this study will therefore come in to fill this whopping knowledge gap in a specific technical and practical subject like cartography [15, 16].

Study Objectives

This study is set on the premise that there exists a negative correlation between plethoric classes and learners' academic performances in cartography. This research paper seeks to examine the challenges faced by teachers and learners in plethoric classes in Cameroon within the context of implementing the CBA under inappropriate conditions. It seeks to assess the teaching-learning conditions in inappropriate leaning environment (plethoric classes), the methods used and the incidence of both on learners' academic performances in cartography. Giving the prevailing circumstances, the paper seeks to provide plausible practical suggestions to enhance acquisition of cartographic skills even in inappropriate teaching/learning environments.

Concept Perspectives

The main underlying concept in this study is plethoric class as a main cause of learners' low performances in cartography as well as an impediment of the proper teaching process of cartography. Cursory meaning of a plethoric class is a congested classroom. According to plethoric classroom is one with a large number of learners—over 50 to above 120 learners in one class. In such classroom, there is little or no space for teachers and students to move freely [17]. Although, the number of students per teacher is generally associated with class size and it is mainly believed that smaller classes provide a better teaching-learning process. In this light, this study considers plethoric classes as typically the ones marked by a large student-teacher ratio compared to the standard number or official number allowed per class (60:1) in Cameroon. Therefore, plethoric classes in this context are classrooms that exceed the standard.

Theoretical Framework

This study is underpinned by a number of theoretical approaches. These approaches are the constructivist approach of Jean Piaget, socio-constructivist approach of Vygotsky and visual semiotics. Piaget's approach looks at learning as an active constructive process which involves *learning by mindfully doing, where learners cognitively manipulate the material, they are learning to create cognitive links from the new material to their own prior knowledge.* In the case of cartographic teaching-learning process, this theory centres on providing classroom activities for individuals and small groups based on individual progress. This allows learners of different cognitive levels to work together to enhance understanding.

Vygotsky's socio-constructivist theory shows that learners are co-constructors of their own knowledge as they interact with their environment (Zone of Proximal Development—ZPD). In this study, Vygotsky's theory implies that learners need appropriate, spacious and well-structured conducive environments (classrooms) where interactions can be possible. This is because teaching and learning cartography ensure that everyone possesses an equal chance to participate in the process and to succeed as well.

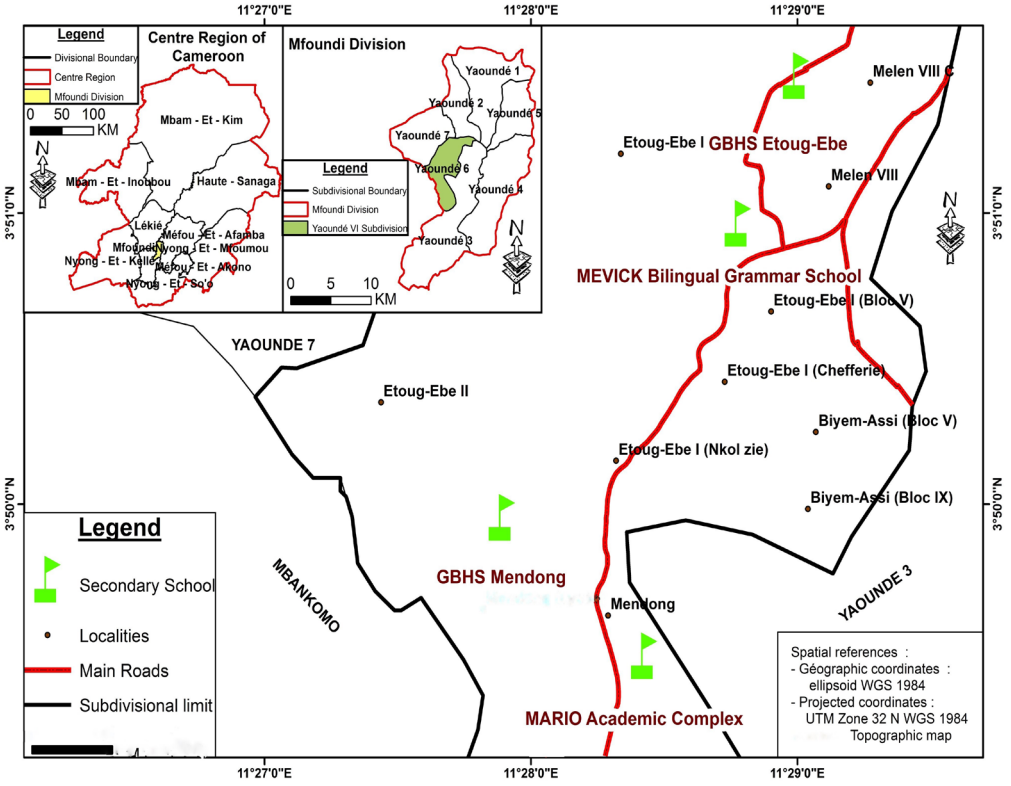
Visual semiotics is indispensable in teaching-learning of cartography. It is a sub-section of semiotics that analyses the way visual images communicate a message. This is an approach that seeks to interpret messages in terms of signs and patterns of symbolism. This has been expanded by Charles Pierce Sanders and in the practical analysis model of cartography of Jean-François Thémines. The semiotic approach is significant in the teaching-learning process of cartography because each learner must identify a symbol and its meaning—which is known in visual semiotics as symbolic and signification. With this theory, learners equally identify the differences between geographical phenomena on a map—which is known in visual semiotics as significance and difference. Also, the importance of the elements shown on the map triggers learners' ability to read and interpret the map—which is known as the level of semiotic. Finally, maps transmit the required information to learners and ease the understanding of cartography; this is known as significance and comprehension. Based on this theory, there is no Geography teaching

without a map. Therefore, there is no Geography textbook without a map [18]. In order for the teacher to constitute the semiotic language in cartography for better understanding, emphasis is centred on the visual entities of the map like the form of the map, the dimension, orientation, colour, value of the map, the dynamics and structure of the map, and the properties of geographical entities on the map. All these elements make up the semiotic approach in cartography that the teacher must follow for better understanding by learners.

Materials and Methods

Spatial Framework

Yaounde, spreads over 7 hills, is the capital city and the second-most populous municipality of Cameroon (about 2,440,062). It lies in the Centre Region of the nation at an elevation of about 750 m a.s.l. Administratively, it comprises seven subdivisions. This study was carried out specifically in Yaounde VI Subdivision (latitudes 3°50′0″N and 3°51′0″N; and longitudes 11°27′0″E and 11°29′0″E) of Mfoundi Division in Cameroon (Figure 1).



Source: Outline map: Administrative map of Cameroon, drawn by the author

Figure 1: Map showing Yaounde VI Subdivision, Cameroon

It was conducted in four learning institutions of the Anglo-Saxon subsystem: Government Bilingual High School (GBHS) Etoug-Ebe; GBHS Mendong; MARIO Academic Complex; MEVICK Bilingual Grammar school; the two former being state institutions and the latter two, being private learning institutions.

Procedure

This qualitative study made used of a multiple sampling procedure. The first procedure involved purposively selecting the study area owing to many Anglo-Saxon secondary and high schools and the high proportion of English-speaking Cameroonians in this subdivision.

The second procedure involved the sample of 4 schools out of a total of 15 secondary and high schools running the Anglo-Saxon subsystem of education based on their general enrolment and number of students per class. In order to get a representative picture of the entire subdivision, some 3 more schools were sampled through the help of Regional Pedagogic Inspectors (RPIs) for Geography and geography teachers (via interviews). Thus, 4 schools were sampled directly for this study and 3 others sampled through RPIs and geography teachers.

The third procedure involved the stratification of the target state and private secondary schools in the subdivision wherein, form 5 learners (to whom cartography is taught in the sampled schools) were randomly selected for the survey.

Table 1: Number of Students and Teachers Who Participated in the Study

School	Students sampled		Teachers sampled		Response rate (%)
	Frequency	%	Frequency	%	
GBHS Etoug-Ebe	99	49.29	5	38.5	100
GBHS Mendong	45	22.63	4	30.7	100
MARIO	36	17.90	2	15.4	100
MEVICK	20	10.16	2	15.4	100
Total	**200**	**100**	**13**	**100**	**100**

In addition, interviews with pedagogic inspectors for Geography and Geography teachers were conducted in the four learning institutions under study. This was done through questionnaire ration. A total of 200 students in the four learning institutions and 13 Geography teachers (who teach cartography) were sampled during the survey with a 100% response rate (Table 1).

Data Collection

The study employed both qualitative and quantitative methods to collect primary data. The methods used were: field surveys, Key Informant Interviews (KIIs), and direct observations. Most of the primary data were collected through field survey with structured and semi-structured questionnaires wherein teachers and learners constituted the sampling unit. KIIs with purposely selected resource persons in the study area provided general information to complement the data obtained through field surveys (questionnaires). Classroom observations were also frequently undertaken in order to ascertain the veracity of the responses obtained from surveys. Primary data was collected cognisant of the overcrowding scenarios of the study area. Secondary data mainly on past trimestral results and Mock Exam results was collected from various heads of departments (HOD) in sampled schools.

Data Analysis

Statistical analysis of data was done on the Statistical Package for Social Sciences (SPSS) 16.0 and Microsoft Excel 2016. Both descriptive and inferential statistics were employed in the study. Descriptive statistics employed were percentage indices and charts while inferential statistics employed were Kruskal-Wallis (H) test and ANOVA.

The H-test (Equation 1) was run to test whether there was a significant variation in teaching methods used in plethoric classes across different schools. The H-test which is the non-parametric equivalent of the ANOVA test is computed as follows:

$$H=\frac{12}{N(N+1)}\left[\frac{R_1^2}{n_1}+\cdots+\frac{R_k^2}{n_k}\right]-3(N+1) \quad (1)$$

Where: N = total number of cases; n = number of cases in a given sample; Ri = rank for a given sample.

The One-Way Analysis of Variance—ANOVA test (Equation 2) on the other hand was run to test whether there was a significant difference between learners' performances in plethoric and non-plethoric classrooms across different schools. The model assumed for the observation of a one-way design is computed as follows:

$$yij=\mu i+\varepsilon ij \quad (2)$$

Where: ***yij*** represents the jth observation in the ***ith*** group, and the ***εij*** represents random error terms, assumed to be from a normal distribution with mean zero and variance σ^2

Key Findings

Legal Canons on Classroom Student Population in Cameroon

The canonical structure of classroom population as stated in the official document guiding the recommended number of learners per class in the General Secondary Education in Cameroon by the Ministry of Secondary Education (MINESEC) stipulates that, the maximum number of learners in divisions (classes) and specialties per cycle of learning institutions is as follows:

For Government Secondary Schools (GSS)

For government secondary schools, the maximum number per class is assigned as follows:

- For schools located in areas with a very high concentration of school-aged population, a maximum of 2,160 students in 36 divisions is required. This gives a maximum population of 60 learners per class.
- For schools located in areas with a moderately high concentration of school-aged population, a maximum of 1,680 learners for 28 divisions is required giving a student population of 60 per class.
- For schools located in areas of medium concentration of school-aged population, a maximum of 960 students for 16 divisions is accepted giving a student population of 60 per class.

With regards to bilingual secondary schools and their given specificities, their structure varies according to the demand; however, the numbers do not exceed those of secondary schools located in areas with a very high concentration of school-age population.

For Government Bilingual High Schools (GBHS)

Their specificities should be taken into account as follows:

- For Anglo-Saxon full cycle high schools, a maximum of 2,760 students for 46 divisions is required giving a student population of 60 per class.
- For Francophone full cycle high schools, a maximum of 2,520 students for 42 divisions is accepted giving a student population of 60 per class. With regards to vertical extensions, the cylindrical shape will be adopted as far as possible.

In this vein, all the learning institutions sampled for this study were high schools of general education and all situated in zones of very high concentration of school-age population. Following the specificities of this ministerial order, the total population of sampled students stood at 994 in the four sampled schools. In order to have the recommended number of students which is 60 students per class, 16 divisions or classrooms are needed with regards to the total student population at 994.

The reality on the field showed that some classrooms accommodated about 150 students and only 10 classrooms for 994 students which are more than the recommended number of 60 students per class and 16 classrooms for 994 students. Teachers are therefore unable to effectively teach cartography in classrooms with these scenarios (cf. Insert 1).

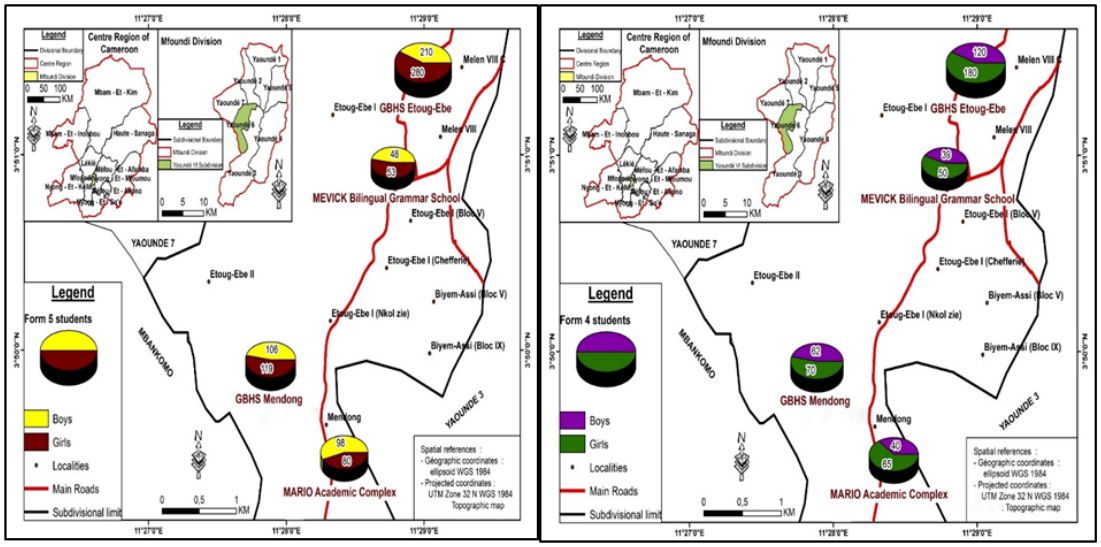
Insert 1

Our classrooms are very plethoric and do not give us the possibility to teach properly. As a result, I always teach with a single map which I use to demonstrate to students how to handle exercises in map reading and I only advise them to tackle as many questions as possible on map reading in order to familiarize themselves with the questions and techniques which would permit them to better understand the basic concepts in map reading, otherwise teaching map reading in plethoric classes is very challenging as a lot of skills are involved. Head of department, Geography GBHS Etoug-Ebe

From this statement, it implies that students do not receive proper training on how to tackle questions in cartography. With insufficient maps for students, the direct incidence is low performances.

Unconventional Classroom Enrolment

The general trend of student enrolment depicts that state schools have more plethoric enrolments than private institutions. GBHS Etoug-Ebe has the highest Form 5 class enrolment with 490 students. GBHS Mendong is the second institution with the highest classroom enrolment of 225 geography students in Form 5 (Figure 2).



Source: Field data, 2018

Figure 2: Student Enrolment in Sampled Schools

Generally, the two Government Bilingual Secondary High Schools sampled in this subdivision have more plethoric numbers than the private institutions. With the private institutions, MARIO Academic Complex has the highest enrolment in Form 5 with a total of 178 students while MEVICK Bilingual Grammar School has an enrolment of 101 Geography students. From these results, it is observed that, the general enrolments in Form 5 classes are plethoric.

Student enrolment in Form 4 is less plethoric however; it is above the recommended number. In GBHS Etoug-Ebe Form 4 enrolment stands at 300 students (Figure 2). GBHS Mendong has 132 students. Looking at the private institutions, MARIO Academic Complex has 105 students that outnumber MEVICK Bilingual Grammar School which has 89 students (Figure 2).

Teaching Methods in Plethoric Classes

Teachers use different methods to teach cartography in plethoric classes. Assignment is the most used method in teaching cartography in plethoric classes (Table 2). Almost all the teachers (92.3%) give assignments as a strategy to improve on learning skills and reduce workload in plethoric classes. Over 69% of teachers provide enough topographic maps and other didactic materials like graph papers for learners when the classroom is overcrowded, while 61.5% show an example on the blackboard and allow the learners to do the exercises and 53.8% use group work in plethoric classes. Teachers in some schools used diverse methods than their counterparts in other schools (Table 2).

Table 2: Methods Use in Teaching Cartography in Plethoric Classes

Teaching methods	Frequency of respondents (n=13)	%
Assignment	12	92.3
Provide sufficient didactic resources	9	69.2
Show chalkboard example	8	61.5
Group work	7	53.8
Reward best group	3	23.1

Source: Field data, 2018 *Teachers use a combination of methods

Based on the mean ranks of the H-test, it was noticed that faced with plethoric classes, cartography teachers in MEVICK (mean rank = 8.00), GBHS Etoug-Ebe (mean rank = 7.30) used diverse teaching methods than their counterparts in MARIO (mean rank = 6.50) and GBHS Mendong (mean rank = 6.38), (Table 3).

Table 3: Ranking Teachers' Teaching Methods in Plethoric Classes According to Schools

School	Teaching Methods (%)					Mean rank	X^2	p-level
	Group work	Provide enough didactic resources	Show blackboard example	Reward best group	Assignment			
GBHS Etoug-Ebe	7.7	7.7	0	7.7	15.3	7.30	0.323	0.956^{ns}
GBHS Mendong	7.7	7.7	0	7.7	0	6.38		
MEVICK	0	7.7	7.7	0	7.7	8.00		
MARIO	7.7	0	7.7	0	0	6.50		
ns = not significant (p>0.05)								

However, the H-test statistic indicated that there was no statistically significant difference in teaching methods in plethoric classes across different schools (X2 = 0.323, p > 0.05). This indicates that teaching methods in plethoric classes did not vary significantly across the four learning institutions under study (Table 3).

Students' Perceptions on The Methods Teachers Use in Plethoric Classes

Students' opinions concerning the methods used in teaching cartography were assessed and 30% of students reported that teachers use demonstration method when the classroom is overcrowded (Table 4). Here, the teacher demonstrates activities on the chalkboard and students follow up and develop skills. Over 27% of students were of the opinion that, when the classroom is overcrowded, the teacher tends to use the question and answer method. The question and answer method is a method where the teacher simply asks questions on the lesson and obliges students to answer them. Meanwhile, 25% of students were of the opinion that, teachers only lecture during cartography lessons using 'frontal teaching' when the class is overcrowded. Group work method is rarely used by teachers and only 18% of students said teachers use group work (Table 4). Some of these methods are not ideal in imparting cartography skills yet are the most used by teachers. For instance, lectures while standing at the spot and question and answer methods are not the best methods but are most used than the ideal group work and demonstration methods. Thus, this retards understanding cartography skills among learners leading to underwhelming performances.

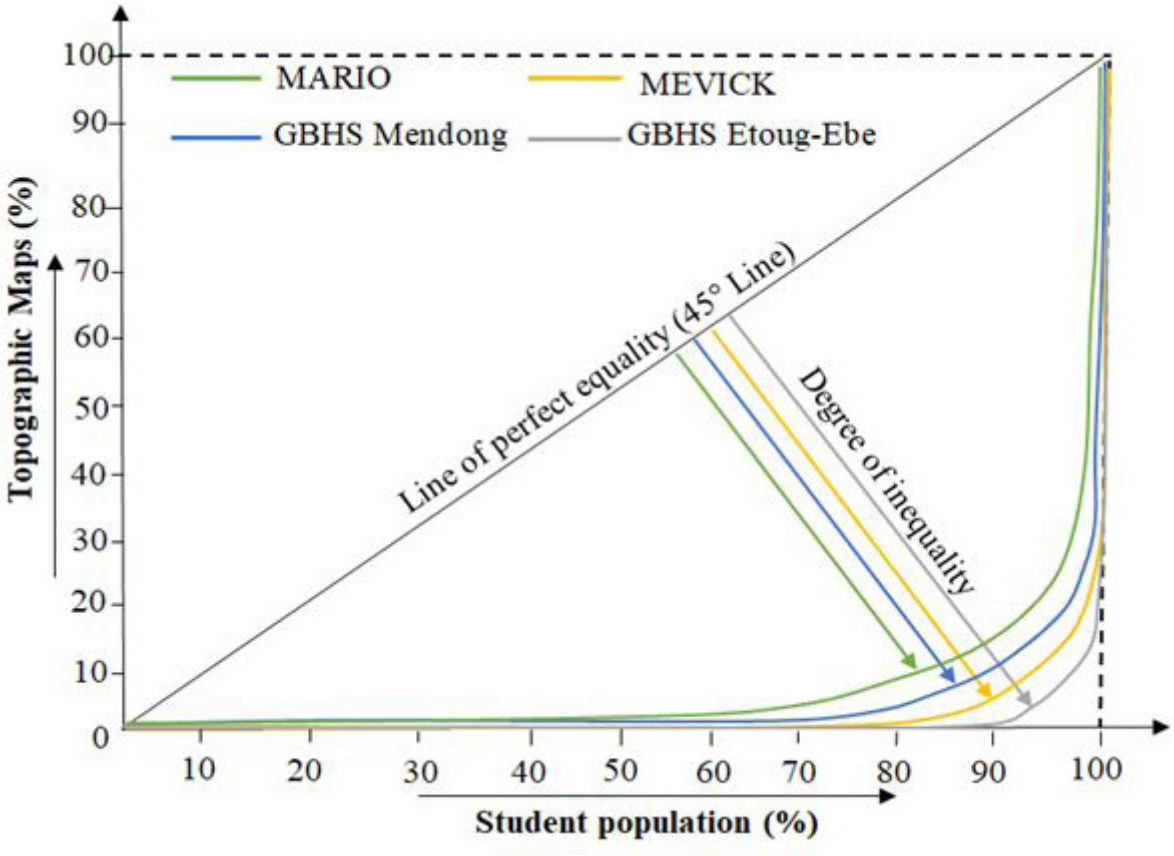
Table 4: Students' Opinion on the Methods Used in Teaching Cartography

Teaching methods	Frequency of respondents	%
Demonstration method	60	30
Question and answer method	54	27
Lectures while standing at the spot	50	25
Group work	36	18
Total	**200**	**100**

Source: Field data, September 2018

Students-Cartography Teaching/Learning Resource Gap

Student-resource gap is a crucial aspect that can determine students' academic performances in cartography. When the ratio between learners and topographic maps is equal (one-student-one-map) teaching-learning activities are well conducted. On the contrary, when there is inequality in the provision of maps and the number of students in class, the student-resource gap becomes widened and this impedes the successful teaching/learning of cartography as shown on the Lorenz Curve (Figure 3).



Source: Based on field data, September 2018

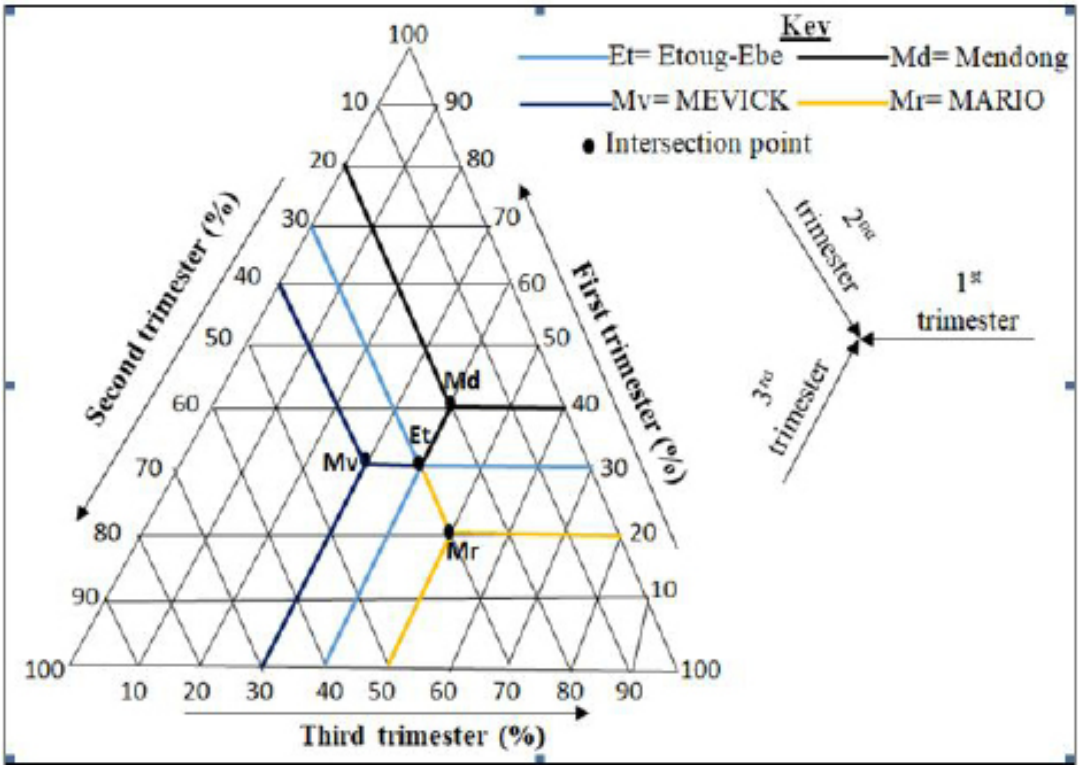
Figure 3: Students-Cartography Teaching/Learning Resource Gap

It shows that in MARIO Academic Complex only 34% of students have access to topographic maps—maps provided by the school authorities (Figure 3). It is noticed that MARIO Academic Complex has the lowest student-resource gap compared to other institutions. In GBHS Mendong, only 28% of students have access to topographic maps for practical exercises in the classroom (Figure 3). Looking at the curve of MEVICK Bilingual Grammar School, it is evident that only 20% of students have access to topographic maps. Here, the inequality gap between learners and topographic maps is wider as compared to MARIO Academic Complex and GBHS Mendong. GBHS Etoug-Ebe with the highest students-teacher ratio (STR) in the study area has a startling large student-resource gap with only 17% of students who have access to maps during cartography lessons (Figure 3).

Correlation Between Students' Academic Performances in Cartography and Plethoric Classrooms

Students' Trimestral Performance in Cartography During 2017/2018 Academic Year

The ternary diagram shows the trimestral performance of students in cartography in the study area (Figure 4).



Source: Based on field data, 2018 *Percentages are rounded to the nearest tens

Figure 4: Students' Academic Performances with Regards to Plethoric Classes

The results in GBHS Etoug-Ebe show a general score of 30% in the first trimester, 30% in the second trimester and 40% in the third trimester. Generally, the performances are low in the first two trimesters with a slight increase of 10% in the third trimester given that students have learnt some skills during the first two trimesters. This is clearly evident as the intersection point of the three trimesters is around the centre of the ternary diagram implying that the results were static throughout the academic year (Figure 4).

In GBHS Mendong, the performances were higher in the first trimester with 40% as compared to GBHS Etoug-Ebe which can be justified by the difference in teaching/learning approaches, 20% in the second trimester and 40% in the third trimester with the intersection point also located around the centre of the graph. In MEVICK Bilingual Grammar School, the performances in cartography stood at 30% in the first trimester, 40% in the second trimester and 30% in the third trimester. MARIO Academic Complex has 20% in the first trimester, 30% in the second trimester and average (50%) in the third trimester. All the sampled schools have their intersection points clustered at the centre of the graph signifying that their results were static with no substantial improvement with an exception of MARIO where the intersection point is a little southward indicating a slight improvement in the third trimester.

A more critical analysis of Figure 4 shows that results are generally poor in the first trimester and improve in the third trimester. The poor results recorded amongst the Form 5 students during the first trimester was due to the fact that cartography is taught only in Form 5 in spite the exigencies of the official syllabus which indicates that cartography is taught in Forms 4 and 5. All the teachers teach cartography only in Form 5 in the sampled schools (cf. Insert 2). Lessons that are supposed to be taught in Form 4 in order to build students towards the end of year examination are accumulated and taught in Form 5 which retards the acquisition of cartographic skills and equally pose a challenge for teachers as they barely finish their workload thus, leading to low academic performances.

Insert 2

Cartography is a section of Geography that involves a lot of skills. Although the official syllabus shows that it is supposed to be taught in Forms 4 and 5, I teach it in Form 5 so that students will write the General Certificate of Education (GCE) examination with the skills still fresh on their minds.

Geography teacher GBHS Mendong

Performances at Mock Exam in Cartography of the 2018/2019 Academic Year

Data sourced on students' performances in the end-of-year Regional Mock Examination revealed that out of the 490 students in Form 5 in GBHS Etoug-Ebe only 9% of students scored above average (above 15/30), while the rest of the students 91% scored below average (Table 5). These performances in GBHS Etoug-Ebe are underwhelming as compared to that of the trimester exams in the 2017-2018 academic year. This shows that the teaching-learning process of cartography in this school has not witnessed any improvement owing principally to the fact that the student population keeps increasing as reckoned by the HOD of Geography (cf. Insert 3).

Insert 3

Due to the on-going socio-political upheavals in the two English-speaking regions of Cameroon, we have had a double increase in the number of students in our institution. This increase in student population does not only demand improvising didactic resources used for a proper teaching-learning process of cartography, it also hampers the teacher's ability to manage a classroom of roughly 150 students and consequently their performances drop.

Head of department, Geography GBHS Etoug-Ebe

Table 5: Students' Mock Exam Performances in Cartography in GBHS Etoug-Ebe (2017-2018)

Student		**< Average (<15/30)**				**Average (15/30)**				**>Average (>15/30)**			
		Female		**Male**		**Female**		**Male**		**Female**		**Male**	
F	M	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
280	210	261	53.3	185	37.8	12	2.4	08	1.6	11	2.2	13	2.7
Total= 490		**Total= 91%**				**Total= 4.1%**				**Total= 4.9%**			

* Cartography is evaluated on 30, Freq. =Frequency, F=Female, M=Male, Source: Field data, April 2019

In GBHS Mendong, findings revealed that out of 225 students in Form 5 only 3.1% of students scored above average in cartography. Meanwhile 2.2% of students scored an average of 15 on 30. This means that only a total of 5.3% students passed in cartography. On the whole, 94.7% of students failed (Table 6). Implying that learning cartographic skills is still a nightmare for students in this school and teachers on their part, need to upgrade and adopt plethoric classroom-smart strategies in order to deal with this difficulty.

Table 6: Students' Mock Exam Performances in Cartography in GBHS Mendong (2017-2018)

Student		***< Average(<15/30)***				***Average(15/30)***				***>Average(>15/30)***			
		Female		Male		Female		Male		Female		Male	
F	M	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
119	106	111	49.3	102	45.3	04	1.8	01	0.4	04	1.8	03	1.4
Total= 225		**Total= 94.7%**				**Total= 2.2%**				**Total= 3.1%**			

* Cartography is evaluated on 30, Freq. =Frequency, F=Female, M=Male, Source: Field data, April 2019

In MARIO Academic Complex, out of 178 students in Form 5, only 18.5% of students scored above average and 4.5% of students scoring an average giving a total pass of 23% (Table 7). The results in this school show a slight improvement as compared to that in the previous learning institutions. Students' performances in the 2017-2018 trimester exams in this school were also encouraging. This could be accounted for by the better management of classroom activities and also the lower STRs as compared to the scenarios in the aforementioned learning institutions.

Table 7: Students' Mock Exam Performances in Cartography in MARIO (2017-2018)

Student		***< Average(<15/30)***				***Average(15/30)***				***>Average(>15/30)***			
		Female		Male		Female		Male		Female		Male	
F	M	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
80	98	60	33.7	77	43.3	03	1.7	05	2.8	12	6.7	21	11.8
Total= 178		**Total= 77%**				**Total= 4.5%**				**Total= 18.5%**			

* Cartography is evaluated on 30, Freq. =Frequency, F=Female, M=Male, Source: Field data, April 2019

In MEVICK, 101 students sat for the mock exams and 17.8% scored above average with only 7.9% with an average giving a total passed of 25.7% (Table 8). This shows that 74.3% of students failed. Looking at the performances in all the four institutions, it can be judged without contradiction that cartography is still far from being a section of geography that attracts students in secondary high schools in Yaounde.

Table 8: Students' Mock Exams Performances in Cartography in MEVICK (2017-2018)

Student		*< Average(<15/30)*				*Average(15/30)*				*>Average(>15/30)*			
		Female		Male		Female		Male		Female		Male	
F	M	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
53	48	43	42.6	32	31.7	03	03	05	04.9	07	6.9	11	10.9
Total= 101		**Total= 74.3%**				**Total= 7.9%**				**Total= 17.8%**			

* Cartography is evaluated on 30, Freq. =Frequency, F=Female, M=Male, Source: Field data, April 2019

Impact of Weighted Variables

In order to show that there is a significant difference in the performances of students who learn cartography in plethoric classes and those in classrooms with normal STR, the Analysis of Variance—One-Way ANOVA test was used (Table 9).

Table 9: Difference Between Performances in Plethoric and Normal Classroom Scenarios

Source of variable	Sum of squares	Mean square	F	p-level
Between Groups	1826.900	608.967	26.545	0.000*
Within Groups	22711.374	22.941		
Total	**24538.274**			

*Significant at 5% probability level

Table 8 shows that there is a statistically significant difference (0.000, $p<0.05$) in students' performances with regards to the total number of students in classrooms within the four learning institutions under study. This implies that, in schools where classrooms are overcrowded, performances are low as compared to schools where classrooms are not overcrowded. In this vein, a 'posthoc' (a posteriori) multiple comparisons test was done to find out exactly where the differences are (Table 10).

Table 10: Multiple Comparisons of Plethoric and Normal Classes with Regards to Performances

(I) School	(J) School	Mean difference (I-J)	p-level	95% Confidence Interval	
				Lower Bound	Upper Bound
1 GBHS Etoug-Ebe	2	2.119*	0.000	1.12	3.12
	3	-2.373*	0.000	-3.71	-1.03
	4	-1.198*	0.021	-2.27	-0.13
2 GBHS Mendong	1	-2.119*	0.000	-3.12	-1.12
	3	-4.492*	0.000	-5.97	-3.02
	4	-3.318*	0.000	-4.55	-2.08
3 MEVICK	1	2.373*	0.000	1.03	3.71
	2	4.492*	0.000	3.02	5.97
	4	1.175 ns	0.196	-0.35	2.70
4 MARIO	1	1.198*	0.021	0.13	2.27
	2	3.318*	0.000	2.08	4.55
	3	-1.175 ns	0.196	-2.70	0.35

*The mean difference is significant at the 0.05 probability level; ns= not significant

From Table 10, it is seen that there is a statistically significant difference ($p<0.05$) between students' performances in schools 1 and 2 (GBHS Etoug-Ebe and GBHS Mendong) and the performances in schools 3 and 4 (MEVICK and MARIO) with regards to plethoric and non-plethoric classes. Looking at the level of significance, Schools 1 and 2 are significant ($p<0.05$) meanwhile schools 3 and 4 are not significant ($p>0.05$). In a nutshell, students in schools 1 and 2 are affected by the large number of students in classes due to lack of student-teacher interaction thus, poor performances while students in schools 3 and 4 have some freedom in classroom interaction thus, performances are higher than they are in the former two schools.

Discussion

This study proves that plethoric classes have a negative influence on students' academic performances in cartography in the study area. Findings revealed that, classrooms were plethoric with each classroom having more than 100 students which hinders the successful teaching/learning of cartography. Although some studies in Cameroon and West Africa have reported that inadequate infrastructure, resources and unstructured teaching/learning environment and a large class size only make the school

problem worse, no research has been conducted to show the impact of this adequacy on students' academic performances in a specific teaching/learning discipline. However, the present study demonstrated this knowledge gap in a skill-based subject—cartography thus, giving a new insight on the existing literature and paving the way for future research exploring unstructured teaching/learning environment and students' academic performances in other disciplines [18-21].

In Cameroon secondary schools of the Anglo-Saxon subsystem, little or no research had been done that demonstrated the influence of plethoric classes on poor academic performances in cartography among students. However, some studies conducted in different parts of Africa on general poor performance as a result of plethoric classes have shown that plethoric classes hinder the teaching/learning process and therefore lead to poor learning outcomes among students [14, 19, 4]. This is typical in Cameroon schools where the normal class student population is fixed at 60 but it is common to find a class of 80 students and above, which is the case with this present study. These findings equally corroborate the scenario in most African countries where many classes are on the overall plethoric. These unstructured environments are not conducive for students to learn especially during a skill-based lesson like cartography. Studies in Cameroon in particular have done little to show students' performances in classrooms with such scenarios. This is because these findings are superficial and descriptive with little or no quantitative data showing students' performance due to plethoric numbers. The findings of this study have therefore come in to fill this knowledge gap in a specific domain—cartography [19].

This survey also revealed that teachers used different methods to teach cartography when the classes are plethoric and these methods did not vary across the different schools. The method frequently used by teachers is giving assignments to students (over 92%). This shows that teachers are unable to manage classrooms with students exceeding 100 and this makes them to adopt the teacher-centred than student-centred methods in teaching cartography. This explains the poor performances of students in cartography in the sampled schools and corroborates findings that students who work in small groups have a slightly better understanding of map concepts than those who work individually [22]. Although some studies have been carried out on teaching/learning environments in Africa, little or no research has been done to show the ordeals of teachers and learners in such teaching/learning environments and the resulting effects on students' academic performances. However, studies conducted within the context of teaching/learning environments are more general than specific. It was in this light, this study sought to fill this gaping knowledge void in a specific discipline like cartography with a goal to influencing policy [23-25].

Concerning students-cartographic teaching/learning materials, it was found that there exists a wide gap between students and cartographic teaching/learning resources like topographic and/or ordnance survey maps. The maps used in teaching cartography are too few for the number of students in class. This makes the teaching/learning process of cartography very challenging for teachers and students and therefore poor results in cartography become evident. This limited didactic material contradicts the exigencies of the CBA because this approach necessitates enough didactic resources in the teaching/learning process notable when teaching more practical lessons like cartography. This corroborates the findings of wherein sufficient topographic maps are required for better performance in cartography. This is equally authenticated by which revealed that, the provision of teaching/learning materials like textbooks and maps is one of the most effective ways of improving results and performances, especially where the teaching/learning environment is not conducive. It is important to say that didactic materials play a preponderant role in enhancing students' academic performances. Although the aforementioned studies have reported the influence of limited didactic materials on academic performances (though superficial and based on literature review), this current study is one of the first to conduct a broad-based assessment of teaching/learning environment and its repercussions on students' performances in a specific discipline. It therefore makes a new insight to the existing literature by exposing a need to consider plethoric classes and students' academic performances in future research exploring other academic disciplines in similar teaching/learning environments [26-28].

Looking at the overall performance of students in cartography in the sampled schools, it is noticed that much needs to be done if students are expected to perform well. Results in general are very unsatisfactory both in states schools and in private institutions owing principally to the general STR in these schools. STR and the incidence of transmitting cartography skills is the main challenge in these schools. Teachers especially in state schools face many difficulties transmitting cartography skills in such teaching/learning environments with students exceeding 100 per class coupled with insufficient didactic resources. Although private institutions have lower STR, however still exceed the recommended number. Students' academic performances in cartography in the private sampled schools show a slight improvement from state schools due to low STR but on a whole not satisfactory. These above-mentioned scenarios are consistent with the findings of other authors Given that these authors reported just difficulties in teaching/learning in unstructured environments (classrooms), the present findings have assessed students' performances in such environments. This therefore gives a new insight on the existing literature and paves a way for future research exploring unstructured teaching/learning environment and academic performances [29-31].

Given that the aforementioned literature focused on the entire performances in general while some were focused on particular subjects, the findings of this current study therefore focused on cartography which is a skill-based subject and entails a CBA in teaching it. This study therefore makes a new insight that supports and extends the existing literature by exposing a need to consider cartography teaching in future studies exploring the CBA in education.

Perspectives

More classrooms need to be constructed in order to reduce the rate of overcrowdings. Availability of enough classrooms will enhance the effective teaching and learning of cartography and

in turn boost academic performances. There should equally be the implementation of the Book-Student Ratio (BSR) to be 1:1 within each learning institution. This will need to be enforced through the provision of sufficient didactic resources for easy teaching/learning. Educational stakeholders in collaboration with the GCE Board should make sure they provide enough topographic maps (coloured maps) and other cartography related tools for learning institutions which are competence based. This may be done in such a way that they are cheap and affordable, but rich in content in order to improve the level of performance in cartography during the GCE Examination.

In cases where overcrowded classes could not be broken down as a result of factors beyond the control of administrators and teachers, teachers should instil group work, photocopy enough topographic maps, harmonize activities and focus on grouping the students into different tutorial groups with different time tables. This will give room for efficiency, monitoring students' participation in the class, identifying the deviant students, identifying students' individual differences and making the available didactic materials to circulate successfully in class during cartography lesson. In such tutorial groups, teachers should employ classroom-smart strategies which are purely practical so as to encourage students to develop acquaintances with the subject matter. Teaching should be student-centred.

Conclusion

This research paper found that plethoric classes influence students' academic outcomes in cartography negatively. Students scored low grades in cartography both at class exams and regional exams. School administrators therefore need to provide immediate or short-term solutions through furnishing adequate and good didactic materials in order to incentivise teachers to diversify the use of the CBA in teaching/learning process thus, improving academic outcomes amongst students and optimising their knowledge of cartography. Teachers equally need to provide additional support by photocopying enough topographic maps for students with the support of the institution in charge. Plethoric classroom scenarios cannot be avoided; diversifying strategies can prove successful in dealing with such challenges.

Conflict of Interests

The authors have declared no competing interests

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