Content Of Computer Studies Programme Taught In Secondary Schools In Cameroon

A Comparative Analysis Of The Differences By School Type, By Type Of Education And Location

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Abstract*— This study investigates the content of computer studies programme taught in secondary schools in Cameroon: A comparative analysis of the differences by school type, type of education and by location. A survey was carried out in 120 secondary schools in the 10 Regions of Cameroon. Data were collected through various means: document analysis, classroom observations, questionnaires, interviews, analysis of students' academic performance in computer studies and a focus group discussion with national inspectors. The collected data were analysed using independent t-test and one way analysis of variance. Findings revealed that the socio-economic environment, type of school and type of education significantly affect the computer studies programme implemented in secondary schools. Also, sub-urban and rural secondary schools do not differ significantly as far as the content of the computer studies programme is concerned. Lastly, schools offering general education and those offering general and technical education in the same premises do not significantly differ in terms of the content implemented for computer studies. The study recommended inter alia, effective follow-up and supervision of the programme implementation and other alternative solutions for the acquisition and the "mutualisation" of equipment so as to enable under-privileged secondary schools to implement computer studies effectively.

***Keywords*— content; school type; type of education; location; computer studies programme; secondary schools**

I. INTRODUCTION

Computers are useful in almost all the sectors of human activity in this 21st Century. The point here is that no matter where people find employment, ask for services, submit information, buy items, deliver or receive instruction, there is a good chance that the computer is used. As Brakel and Chisenga (2003) put it, Information and Communication Technologies (ICTs) in general, and computer in particular, have a significant impact on all areas of human activity. This is the reason why more and more people perceive the need to be computer literate.

The education sector is not free from the invasion of computers and ICTs. Computer related technology has advanced to a level where it cannot only be used to support the teacher, but can actually be used to facilitate the learning process without the direct involvement of the human or life teacher (Tambo, 2012). Research has shown that computers have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthen teaching and school innovation (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005).

The need for computer studies in education cannot be overemphasised, in this technology-driven age. This calls for early acquisition of computer skills by students. The reason is that, we are in an increasingly globalised world where technologies of information, literacy and numeracy are rapidly shifting from paper, pencil and book technologies to screen, search engines and WebPages. Indeed, every element of change in institutions worldwide and the workplace today has important implications for computer studies (Okebukola, 2004). The consequence is that students of the present age find it harder to find a job in certain sectors without being computer literate since employers of labour seem to realise that computers and other ICT facilities enhance efficiency and productivity. Tchombe (2008) recognises this fact when she underscores that in an increasingly interconnected world, brought about by the application of technological advances to all sectors of the society,

quality education necessitates the active and innovative exploration of how best to capitalize on the strengths of computer studies. As a consequence, there is a pressing need to re-conceptualize and to restructure the educational enterprise, so as to confront the technological challenges of this millennium. Worldwide, countries are therefore changing their national education curriculum policy to accommodate the integration of computer studies into teaching and learning. The African continent is not left aside concerning the implementation of computer studies in schools, as a factor of economic and social development.

Conscious of the need of promoting national economic development through computer education, authorities in Cameroon introduced computer studies in secondary schools. In 1995, the Government of Cameroon convened a national forum to make recommendations for reforms in nursery, primary, secondary and teacher education (Tambo, 2003). Among other issues raised during the workshops of that forum were the *moder*nisation and *enhancement of teaching and learning resources to accommodate the changes required by the reforms*. Following the recommendations of the forum, in April 1998, the National Assembly issued law No98/004 to lay down guidelines for the development of education for the decades to come. This education law, however, does not make direct mention of computers and ICT in the school system (Mbangwana et al., 2008).

Although the 1998 law does not mention computer and ICT education specifically, some sections and articles indirectly support the introduction of such studies in the curriculum. Section 4, for example stipulates: *The general purpose of education shall be to train children, bearing on mind prevailing economic, socio-cultural, political and moral factors.*

Section 23, article 2, stipulates: *Education may also be provided through a system of distance education.*

Section 25 prescribes: *The education provided in schools shall take into account scientific and technological advancements and shall be tailored in terms of content and method, to national and international economic, scientific, technological, social and cultural trends* (Cameroon, 1998 in Tambo, 2003).

After that forum, the decision-makers in higher, secondary and basic levels of education carried out the assignment to create institutional organs for exploring computer opportunities in their respective sectors. For the purpose of this research, let us see how the issue of computer studies has been specifically addressed in secondary education, as a response to the education forum.

II. Background to the Study

In 2000, a ministerial order (n°3053/B1/1461/MINEDUC/SG/IGO/ESTP of 28 March) was issued to revise the existing computer programmes in the second cycle of general education. Mbangwana (2008) reports that in his February 2001 message to the youth, the President of Cameroon called on Cameroonians to embrace the knowledge economy; and he as well promised the introduction of computing in schools and the endowment of computer rooms. The impact of this presidential speech accelerated the introduction of computer studies in secondary general and technical schools.

Since October 2001, when the first school multimedia centre by President Paul BIYA was created, more than sixty others have been put in place and equipped in the 10 Regions of Cameroon, by the year 2015. This effort has been accompanied by the appointment and training of staff in charge of integrating computer studies in the teaching and learning process.

Following the above mentioned presidential message to the youth, a National Inspectorate in charge of computer studies was created in 2002 in the Ministry of Secondary Education. The same year, a ministerial decision defining the conditions for the creation of multimedia resource centres (MRCs) in government secondary schools was published (Tetang, 2007). Then in 2003, order n° 3475/D/63 of 17 June introduced computer studies as a separate discipline in the first and the second cycles of general secondary education and teacher training. It was made clear that computer studies would become compulsory beginning in September 2003. But due to organisational difficulties, these courses were not effective in secondary schools.

The Presidential Decree n° 2005/139 of 25 April 2005 to organise the Ministry of Secondary Education gave a significant impetus to the development of computer studies in the secondary education system. Some months later, a Prime Minister's Decree n° 087/CAB/PM of June 2005 created a committee for the integration of computer studies in education in Cameroon (Tetang, 2007).

Education policy documents on computer studies from that date became more focused. In this respect, in 2010, a circular letter (n°20/10/MINESEC/IGE/IP/INFO 30 June

2010) addressed the modalities for deliverance and renewal of agreements between computer contractors and schools.

On 13 January 2011, an order (n°25/11/MINESEC/CAB/13January 2011) created a new training option entirely dedicated to computing and related technologies. On 21 February 2011, the organisation of the computer studies papers in official examinations was issued (order n°37/11/MINESEC/IGE/IP-INFO of 21 February 2011).

On 15 July 2011, the Minister of Secondary Education signed an official text requiring the Information Technology option to be implemented during the following school year.

On 27 July 2011, decision n° 22/11/MINESEC/CAB of 27 July 2011 to open new options in selected Government secondary schools was issued.

The opening of these options placed emphasis on computer studies in Cameroon education. In August 2011, a ministerial order revised the programmes for computer studies in the first and second cycles of secondary general, industrial technical and teacher

education (order n°182/11/MINESEC/IGE/IP-INFO of 22 August 2011).

The number of hours and coefficients allocated to computer studies in the Information Technologies option were defined by order n° 194/11/MINESEC/IGE/IP-INFO of 1st September 2011.Subsequently, the Inspectorate of Pedagogy in charge of Computer Science issued an overall programme for computer studies in secondary education and teacher training colleges.

Further, by decision n°274/11/MINESEC/CAB of 24 September 2011, the Information Technologies option (IT) was opened in some selected Government Secondary schools. In November 2011, a press release (n°58/11/MINESEC/CAB) announced the modalities for the application of order n°37/11/MINESEC/IGE/IP-INFO of 21 February on the organisation of the computer studies paper in official examinations, beginning the following school year.

On 22 August 2011 programmes for the first and second cycles of secondary and teacher training were revised, to be implemented during the 2012 school year. On 2 November a Press Release instituted two computer papers: one as compulsory and the other as elective for general education. These papers were all compulsory for computer engineering series and teacher education (Ministry of Secondary Education, 2011).

Other ministerial provisions have progressively been issued in relation to computer studies in secondary schools. These texts stipulate modalities and conditions concerning the supply and maintenance of equipment, course contents and official examinations.

The following description of classroom practice for computer studies is based on three official documents issued by the Ministry of Secondary Education: (1) the official programmes of computer studies for secondary education (September 2001); (2) and its teaching guide for computer and ICT studies in secondary schools (general and technical) and of teacher training (September 2001); and (3) order n°182/11/MINESEC/IGE/IP-INFO of the 22 August 2011 to revise computer science studies in the first and second cycles of Secondary General, Industrial and Teacher Training schools. The above ministerial order shows that the computer studies programme in Cameroon secondary schools is geared towards 3 main objectives, namely: (1) the development of students' intellectual abilities; (2) "*vocationalisation*" or *professionalization* of education and, (3) the *modernization of teaching*.

Concerning *the development of student's intellectual abilities*, the computer studies programme aims at preparing the student to live in the information society by: equipping him/her with the skills that foster the easy use of the computer technology, integration in a changing environment and encouragement of self-learning.

The professionalization of education means that computer studies should prepare students to use these technologies in their professional career. At the end of each cycle, the student should possess concrete and practical competencies necessary for insertion and adaptation to different job opportunities.

The last objective, which is the *modernisation of teaching*, stipulates that *the introduction of computer studies in Cameroon secondary schools should boost the modernization of teaching by the production, sharing and transfer of resources via the Internet.*

In secondary general education, the computer studies programme is organised into modules: common modules (from form 1 to Upper 6) aiming at the mastery of logical tools for problem solving in a computer setting; and computer carrier oriented modules (from the upper sixth form), for the Information Technology (IT) series.

In IT classes, the targeted goal is the mastery of computer tools for problem solving through the development of computer networks. The courses are organised around three concerns namely: foundation, appropriation and mastery. The topics are almost the same across the curriculum for general education, with increasing levels of difficulties. In technical education, specific software and computer applications are listed for an in-depth study. The computer studies programme for Information Technologies option is oriented towards the acquisition of specific skills or competencies.

Two hours per week are allocated for computer courses in the common modules, though the weekly load for computer courses is five hours. Pedagogic activities are of two types: direct learning and project based learning (by individual students or by a group of students).Lesson plans, log books, records sheets are the prescribed curricular documents. As concerns teaching aids, the curriculum guide recommends teaching aids prepared by the teachers such as hand-outs, didactic programmes, and audio-visual documents. Six teaching methods are specified: problem solving, projects, lectures, demonstrations, oral interaction and discovery methods. The methodology revolves around planning, implementation, follow-up and evaluation. The order n°182/11/MINESEC/IGE/IP-INFO of the 22 August 2011 by the Minister of Secondary Education specifies that a summative evaluation should be done after the completion of a topic or a chapter and that this evaluation may have any of the following forms: oral, written, practical, project, and internship.

This study therefore was set to investigate the content of computer studies programme taught in secondary schools in Cameroon. The main hypothesis was formulated as follows:

The content of the taught computer studies programme significantly differs by socio-economic area (or location), by school type, and by type of education in secondary schools**.**

III. Literature Review

The need for quality control in curriculum implementation is that, when an educational programme is implemented, the general expectation is that its effectiveness will increase with the passage of time. It is observed that an innovation may be

attractive and successful at one point in time and become less attractive to students and teachers at one another point in time. This negative change in the effectiveness that is a decrease in the effectiveness or deterioration of the educational programme is important to assess (Lewy, 1977). Overall, the problem of quality control in programme implementation is how to maintain the effectiveness of the implemented programme over a period of time for the intended student population. What determines the quality of an educational programme? What are the sources of a deterioration of an educational programme and the characteristics of an effective computer studies programme?

The quality of an educational programme is mainly determined by the interaction among (1) the nature and appropriateness of the programme, (2) how it is used by teachers and students, and (3) under what conditions it is used (Lewy, op.cit.). Therefore, the continuous improvement of an educational programme is undertaken not only at the formative and tryout stages but also during and after the large-scale implementation stage.

The sources of a deterioration of an educational programme are related to factors affecting implementation According to Lewy (1977) the first source is how the programme is actually implemented in schools. For example, teachers may miss important steps inadvertently or use some materials wrongly. This is why observation of classroom activities, and questionnaires and check lists can assist to assess the implementation process.

Another source of deterioration is the changes in the conditions of implementation mainly teacher variables and other external variables. Teacher variables include: teacher morale and motivation, teacher perception and attitude toward the new programme, teacher perception of his/her role in the new programme, teacher knowledge and understanding of the contents of the new curriculum. As for external variables, we can list geographical location of schools (urban, rural, remote, etc.), size of classroom, availability of various facilities and teaching equipment, school climate, to name but few.

Computer education is highly dependent on the nature of the technology used. And as it is known, technology is characterized by its evolution. Hence, using technology as means of delivery or as a teaching subject makes it a particular educational issue in this 21st century driven by constant technology advancements. A study on quality characteristics for technology education programmes conducted in North Carolina, in 1999 by Clark and Wenig revealed eight categories of quality characteristics for technology education programmes, namely: (1) philosophy and mission of programme category, (2) instructional programme category, (3) student populations category, (4) programme requirements category, (5) safety and health category, (6) professional development category, (7) facilities/equipment/materials category and, (8) public relations category (see Fig. 3.1).

Clark and Wenig (1999) further report the experience where expert panel members were asked to write indicators general to all technology programmes in North Carolina. During this experience, each indicator was articulated into other programmes that utilize laboratory instruction and programme areas related to industrial or vocational education. This method helped establish standards and the development of quality indicators. In turn, the curriculum development used by this panel allowed computer and ICT teachers and other technology education decision makers to establish needed benchmarks for the computer studies programme in secondary schools, as they teach students to learn to live in a technical world.

Computer studies as a technology innovation in Cameroon secondary schools needs to be addressed. The next section considers its implementation in connection to factors proper to secondary schools environment.

1. Philosophy and Mission of Programme Category:
The programme objectives address the need to teach the application of technology for the present and future needs of society. The philosophy and programme objectives include teaching students the importance of using knowledge, materials, tools, and machines to solve problems by producing products.
Technology teachers are actively involved in developing the philosophical and/or mission statement for the programme.
The philosophy and programme objectives address the need to continually update and revise the curriculum.

2. Instructional Programme Category:
Course content is developed from the course competencies/enabling objectives and utilises approved curriculum guides, courses of study and professional resources.
Course content is allowed to develop and to experiment with new technologies and areas. Course content is affected by the perpetual evolution of technology and society's interaction with that technology.

3. Student Populations Category:
Technology education activities are provided for all students without bias toward gender, ethnic background, achievement, handicap, or dis-advantagement. All students are provided guidance about technology education course offerings at their school. All population types are represented in the technology education programme.

4. Programme Requirements Category:
Sufficient funds are budgeted for equipment and facility improvements to accomplish course objectives.
Administration presents the attitude necessary for growth and development of technology education programmes.
The maximum number of students per period is appropriate for class population and appropriate for the type and kind of instructional activities conducted. Administration is knowledgeable of the need to continually update the technology curriculum.

5. Safety and Health Category:
Technology teachers prepare and teach appropriate lessons on safety. Students participating in technology education classes are required to complete a written safety test on applicable equipment with 100% success.

6. Professional Development Category:
The technology teacher is provided adequate time and finances to attend at least one government sponsored workshop or function.
Adequate funding is provided for technology teachers to participate in local and national professional development according to stated policy and procedures. The technology teacher participates in staff development activities that lead to the correlation of technology education with other related academic and vocational disciplines.

7. Facilities/Equipment/Materials Category:
The technology presented is applicable to the present and future workplace. The appearance and arrangement of the laboratory reflects the mission and philosophy of the programme.
The technology offered in the programme is up-to-date with current technological needs.

8. Public Relations Category:
Teachers and students maintain a high state of visibility through the promotion of class and student activities as a public relations strategy. Students promote and support

Fig.3.1: Quality Indicators for Technology Education Programs (From Clark & Wenig, 1999)

IV. METHODOLOGY

The research design adopted for this study was a cross-sectional survey. This design allowed the researcher to observe computer teachers and students in their classrooms across the ten regions of Cameroon. A sample of 300

computer teachers and 1100 upper sixth students were selected from this population, using random and purposive sampling procedures. Four research instruments were used, which included: two structured questionnaires (paper and electronic), observation checklists, interviews and a focus group discussion guides. The instruments were translated into French, for the French speaking Cameroonians participants. The classroom observation checklist was developed, the purpose being to observe teachers and students' interactions during computer studies classes, as well as the delivery environment. This observation checklist focused on: school characteristics, classroom instructional conditions, students' characteristics, their involvement in instruction, and teachers' characteristics.

Classroom observations were afterward completed with interviews. For this purpose, two interview guides were developed, one for principals and the other for computer teachers. The aim of these complementary interviews was to understand "how" and "why" people reacted the way they did during the observations. The content of these interviews centred on the choices made regarding delivery strategies used by secondary schools, as well as the perspectives for using computers in instruction. Two types of questionnaires were constructed: one for teachers and another one for students from secondary schools where the computer studies programme is implemented. Each of the two questionnaires had four sections. The first section of the questionnaire dealt with the description of the schools participating in the investigation, followed by the description of participants according to gender, age, academic profile and experience with computer studies. The second section was related to the content, sources, and delivery conditions and techniques of the computer studies programme, factors determining the content, sources, and delivery conditions and techniques of the computer studies programme.

The third section of the instrument comprised a list of strategies and a four point Likert scale. This section ended with a question requiring of the participants to evaluate the techniques, methods and means used by secondary school to deliver the content of the computer studies programme. In order to understand whether the questions in the questionnaire reliably measured the same latent variable, we used the Cronbach's alpha. The collected data were analysed using descriptive statistics of mean and standard deviation and student t-test.

V. Findings

A. Descriptive Statistics on the Components of Computer Studies Programme

Table 5.1 and Table 5.2 present the indexes for the computer studies programme components according to students. Among the 17 components of the computer studies programme identified by students, 13 have a mean less than 0.5. These are: programming and database, introduction to networking, algorithm and programming, and initiation to hardware and software.

TABLE 5.1: COMPONENTS OF COMPUTER STUDIES PROGRAMME (STUDENTS' DATA)

Components of the Computer Studies Programme	N	Min	Max	Mean	Std. Dev
Computer project	1000	0	1	.98	.140
Computer assisted design	1000	0	1	.98	.140
Maintenance of ICT equipment	1000	0	1	.96	.196
Orher programmes adapted to your option	1000	0	1	.95	.218
Infography	1000	0	1	.94	.238
Numerical systems and data transfer	1000	0	1	.92	.271
Production of document in text form	1000	0	1	.86	.347
Basics on DOS	1000	0	1	.83	.376
Computer assisted edition/Micro edition	1000	0	1	.80	.399
ICT environment	1000	0	1	.76	.427
Text production	1000	0	1	.72	.449
Spreadsheets	1000	0	1	.70	.458
Introduction to Internet	1000	0	1	.69	.463
Programming and database	1000	0	1	.48	.500
Introduction to networks	1000	0	1	.40	.490
Algorithm and programming	1000	0	1	.39	.488
Initiation to hardware software	1000	0	1	.19	.392
Valid N (listwise)	1000				

Teachers' findings show that 17 programmes out of 17 identified for secondary schools have a mean score >0.75, out 1 point.

TABLE 5.2: COMPONENTS OF COMPUTER STUDIES PROGRAMME (TEACHERS' DATA)

Components of the computer studies programme	N	Min.	Max.	Mean	Std. Deviation
Computer assisted design	250	0	1	.97	.165
Computer assisted edition	250	0	1	.96	.206
Computer project	250	0	1	.96	.196
Infography	250	0	1	.92	.278
Algorithm and programming	250	0	1	.91	.290
Preventive maintenance	250	0	1	.89	.311
Programming and database	250	0	1	.87	.339
DOS	250	0	1	.84	.364
Numerical syst. and data transfer	250	0	1	.83	.378
Introduction to Internet	250	0	1	.83	.378
Spreadsheets	250	0	1	.83	.378
Production of doc. in text form	250	0	1	.81	.395
Introduction to networking	250	0	1	.80	.398
Text production	250	0	1	.80	.398
Other programmes	250	0	1	.79	.410
Computer environment	250	0	1	.77	.420
Initiation to computer	250	0	1	.75	.433
Valid N (listwise)	**250**				

To make the analysis more visible, target variables were computed from the items constituting the variable "computer studies programme". These target variables are therefore: Basics and Initiation to Computer Environments; Programming and Data Base; Communication and Internet; Applied Computer Studies; and Maintenance (see Tables 5.3. and 5.4).

Table 5.3 shows components of the computer studies programme as identified by students. Basics and initiation to computer environments are widely part of the computer studies programme (27.41%), followed by programming and database for 27.17%. Communication and Internet components of the computer studies programme represent 26.73% of the studies in secondary schools. The Applied component of the computer studies programme represents 16.59%. Other components of the programme are taught according to the requirements of a given core curriculum (1.12%) especially in technical education, while 0.09% of the programme in computer studies is

on the preventive maintenance of computer equipment.

TABLE 5.3: TARGET VARIABLES OF THE CONTENT TAUGHT (STUDENTS' ANSWERS)

Content of the Taught Computer Studies Programme	Frequencies	Percentage per Programmes Component	Percentage per Domain of Programmes
Basics and Initiation to computer environment			**27.41**
Initiation to computer (hardware and software)	810	18.20	
Computer environment	240	5.39	
Disk operating systems	170	3.82	
Programming and database			**27.17**
Algorithm and programming	610	13.70	
Programming and database	520	11.68	
Numerical systems and data transfer	80	1.79	
Communication and Internet			**26.73**
Introduction to networking	600	13.48	
Introduction to Internet	310	6.96	
Text production	280	6.29	
Applied computer studies			**16.59**
Spreadsheet	300	6.74	
Computer assisted editing	200	4.49	
Production of documents in text form	140	3.14	
Infographics	60	1.34	
Computer assisted design	20	0.44	
Computer project	20	0.44	
Maintenance			**0.09**
Preventive maintenance	40	4	
Other components of the computer studies content	**50**	**5**	**1.12**

The findings in Table 5.4 show that basics and initiation to computer are the highest taught components of the computer studies programme (27.32%). Other components of the computer studies programme constitute 9.16%. This is particularly the case in technical education where computer studies are integrated to other subjects in the curriculum. Applied computer studies components (24.2%), communication and Internet (21.6%), programming and database (12.95%) and maintenance (4.67%) are also taught in secondary schools.

TABLE 5.4: TARGET VARIABLES OF THE CONTENT TAUGHT (TEACHERS'ANSWERS)

Content of the Taught Computer Studies Programme	Frequencies	Percentage per Programmes Component	Percentage per Programmes Domain
Basics and Initiation to computer environment			**27,32**
Initiation to computer (hardware and software	62	10.72	
Computer environment	57	9.86	
Disk operating systems	39	6.74	
Programming and database			**12.95**
Algorithm and programming	23	3.97	
Programming and database	29	5.01	
Numerical systems and data transfer	23	3.97	
Communication and Internet			**21.6**
Introduction to networking	33	5.70	
Introduction to Internet	43	7.43	
Text production	49	8.47	
Applied computer studies			**24.2**
Spreadsheet	43	7.43	
Computer assisted editing	11	1.90	
Production of documents in text form	48	8.30	
Infographics	21	3.63	
Computer assisted design	7	1.21	
Computer project	10	1.73	
Maintenance			**4.67**
Preventive maintenance of computer equipment	27	4.67	
Other components of the computer studies content	53		**9.16**

Observations and interviews revealed other information concerning the content of the computer studies programme in Cameroon secondary schools. It is worth noting that while the basics-and-communication-related components cut across general and technical education, technical maintenance, programming and applied computer studies components are taught specifically in technical education, although some fundamentals of these aspects may be taught purposefully in general education by teachers. When asked about what should determine the content of the computer studies programme in Cameroon secondary schools, inspectors in charge of computer education at the national level said:

"Normally, the content of the computer studies programme is determined by a ministerial order per type and level of education. However, due to local circumstances, infrastructural disparities and lack of equipment that impede a national harmonization and effective implementation of the computer studies programme in all the secondary schools, each secondary school endeavours to adapt the official curriculum to existing local situation".

B. Test of Hypotheses

The research hypothesis is recalled as follows below:

H01: The content of the taught computer studies programme significantly differs by socio-economic area, by school type, and by type of education in secondary schools.

To make the verification easier, it has been subdivided into three sub-hypotheses:

Ha1.1: The content of the computer studies programme taught significantly differs by socio-economic area (or location) of the school.

Ha1.2: The content of the computer studies programme taught significantly differs by school type.

Ha1.3: The content of the computer studies programme taught significantly differs by type of education.

1) Sub-Hypothesis 1.1

Hi1.1: The content of the computer studies programme taught significantly differs by socio-economic area (or location) of the school.

Ho1.1: The content of the computer studies programme taught does not significantly differ by socio-economic area.

Table 5.5 presents the descriptive statistics on the components of the computer studies programme implemented in secondary schools by socio-economic area, using students' data. There is a difference between the mean for the components of the computer studies programme implemented in secondary schools, with respect to socio-economic area. However, a multiple comparisons in Table 5.6 shows

that the mean difference is not significant for schools in sub-urban and in rural areas (sig.>0.05), with respect to the computer studies programme that apply to students' speciality and for maintenance.

TABLE 5.5: GLOBAL INDEX FOR COMPUTER STUDIES PROGRAMME COMPONENTS BY SCHOOL SOCIO-ECONOMIC AREA (STUDENTS' DATA)

Computer Studies	Components	N	Mean	Std. Deviation	Std. Error	F Values	Sig.
Basics	Urban area	273	.17	.234	.014	2008.309	.000
	Sub-urban area	489	.67	.026	.001		
	Rural area	238	.93	.137	.009		
	Total	**1000**	**.59**	**.315**	**.010**		
Programming	Urban area	273	.24	.152	.009	396.828	.000
	Sub-urban area	489	.67	.301	.014		
	Rural area	238	.86	.274	.018		
	Total	**1000**	**.60**	**.351**	**.011**		
Communication	Urban area	273	.00	.000	.000	2488.383	.000
	Sub-urban area	489	.78	.220	.010		
	Rural area	238	.93	.137	.009		
	Total	**1000**	**.60**	**.410**	**.013**		
Applied	Urban area	273	.57	.233	.014	1171.176	.000
	Sub-urban area	489	.99	.038	.002		
	Rural area	238	1.00	.000	.000		
	Total	**1000**	**.88**	**.228**	**.007**		
Maintenance	Urban area	273	.84	.359	.022	76.625	.000
	Sub-urban area	489	1.00	.000	.000		
	Rural area	238	1.00	.000	.000		
	Total	**1000**	**.96**	**.201**	**.006**		

TABLE 5.6: MULTIPLE COMPARISONS BETWEEN MEANS DIFFERENCES OF THE COMPUTER STUDIES PROGRAMME COMPONENTS BY SOCIO-ECONOMIC AREA (STUDENTS' DATA)

Components of the computer studies programme	(I) Type of education	(J) Type of education	Mean Difference (I-J)	Std. Error	Sig.
Applied Programmes	Sub-urban area	Rural area	-.009	.010	.647
Maintenance			.000	.015	1.000

The mean difference is significant at the 0.05 level.

Teachers' data presented in Tables 5.7 and 5.8 also show that the mean difference is not significant, for all the five computer studies programme components, between schools in sub-urban and in rural areas (sig.>0.05) in relation to the computer studies programme implemented in secondary schools.

TABLE 5.7: GLOBAL INDEX FOR COMPUTER STUDIES PROGRAMME COMPONENTS BY SCHOOL SOCIO-ECONOMIC AREA (TEACHERS' DATA)

Computer Studies Programmes Components		N	Mean	Std. Deviation	Std. Error	F	Sig.
Basics	Urban area	114	.54	.453	.042	70.387	.000
	Sub-urban area	93	1.00	.000	.000		
	Rural area	43	1.00	.000	.000		
	Total	**250**	**.79**	**.383**	**.024**		
Programming	Urban area	114	.71	.410	.038	33.773	.000
	Sub-urban area	93	1.00	.000	.000		
	Rural area	43	1.00	.000	.000		
	Total	**250**	**.87**	**.312**	**.020**		
Communication	Urban area	114	.59	.482	.045	49.519	.000
	Sub-urban area	93	1.00	.000	.000		
	Rural area	43	1.00	.000	.000		
	Total	**250**	**.81**	**.385**	**.024**		
Applied Programmes	Urban area	114	.7953	.29502	.02763	32.623	.000
	Sub-urban area	93	1.0000	.00000	.00000		
	Rural area	43	1.0000	.00000	.00000		
	Total	**250**	**.9067**	**.22346**	**.01413**		
Maintenance	Urban area	114	.6491	.41504	.03887	48.443	.000
	Sub-urban area	93	1.0000	.00000	.00000		
	Rural area	43	1.0000	.00000	.00000		
	Total	**250**	**.8400**	**.32990**	**.02086**		

TABLE 5.8 MULTIPLE COMPARISONS BETWEEN MEANS DIFFERENCES OF THE COMPUTER STUDIES PROGRAMME COMPONENTS BY SOCIO-ECONOMIC AREA (TEACHERS' DATA)

Components of the computer studies programme	(I) Type of education	(J) Type of education	Mean Difference (I-J)	Std. Error	Sig.
Basics	Sub-urban area	Rural area	.000	.057	**1.000**
Programming			.000	.051	**1.000**
Communication			.000	.060	**1.000**
Applied Programmes			.00000	.03680	**1.000**
Maintenance			.00000	.05177	**1.000**

*. The mean difference is significant at the 0.05 level.

Concerning the basic programme component for computer studies, there is a significant difference between schools in urban areas and those located in other areas, according to students and teachers. The analysis of teachers' data on the other hand shows that this difference is not significant. An explanation may be that in urban and in sub-urban areas, since the equipment and resources are present in schools, students can easily apply the content they are taught. Because these students are living in the ICT area, it is more and more necessary that the basic component of computer programme be taught in all schools as prerequisites.

2) Sub-Hypothesis 1.2

Hi1.2: The content of the computer studies programme taught significantly differs by school type.

Ho1.2: The content of the computer studies programme taught does not significantly differ by type of school.

From Table 5.9 and 5.10, the student t-test reveals a significance of 0.00 (<0.05). This means that the taught computer studies programme implemented in public schools differs from those implemented in private schools.

TABLE 5.9: GLOBAL INDEX FOR COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF SCHOOLS (STUDENTS' DATA)

Computer Studies Components	Type of Schools	N	Mean	Std. Deviation	Std. Error Mean	F Values	Sig. (2-tailed)
Basics	Public	714	.48	.283	.011	191.761	.000
	Private	286	.89	.158	.009		
Programming	Public	714	.44	.285	.011	455.676	.000
	Private	286	1.00	.000	.000		
Communication	Public	714	.44	.384	.014	1903.381	.000
	Private	286	1.00	.000	.000		
Applied programmes	Public	714	.83	.254	.009	492.143	.000
	Private	286	1.00	.000	.000		
Maintenance	Public	714	.94	.236	.009	93.808	.000
	Private	286	1.00	.000	.000		

TABLE 5.10: GLOBAL INDEX FOR COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF SCHOOLS (TEACHERS' DATA)

Computer Studies Components	Type of Schools	N	Mean	Std. Deviation	Std. Error Mean	F Values	Sig. (2-tailed)
Basics	Public	195	.73	.414	.030	210.439	.000
	Private	55	1.00	.000	.000		
Programming	Public	195	.83	.344	.025	78.796	.000
	Private	55	1.00	.000	.000		
Communication	Public	195	.76	.421	.030	155.073	.000
	Private	55	1.00	.000	.000		
Applied programmes	Public	195	.8803	.2468	.01768	63.276	.000
	Private	55	1.00	.000	.000		
Maintenance	Public	195	.7949	.36109	.02586	120.340	.000
	Private	55	1.00	.000	.000		

3) Sub-Hypothesis 1.3

Hi1.3: The content of the computer studies programme taught significantly differs by type of education.

Ho1.3: The content of the computer studies programme taught does not significantly differ by type of education.

Table 5.11 presents the descriptive statistics on the taught computer studies programme implemented in secondary schools by the variable type of education, using students' data and teachers' data respectively.

TABLE 5.11: GLOBAL INDEX FOR THE TAUGHT COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF EDUCATION (STUDENTS' DATA)

Computer Studies Components	Type of Schools	N	Mean	Std. Deviation	Std. Error	F Values	Sig.
Basics	Technical	500	.39	.304	.014	347.039	.000
	General	485	.79	.160	.007		
	General and Technical	15	1.00	.000	.000		
	Total	**1000**	**.59**	**.315**	**.010**		
Programming	Technical	500	.28	.122	.005	2225.881	.000
	General	485	.91	.176	.008		
	General and Technical	15	1.00	.000	.000		
	Total	**1000**	**.60**	**.351**	**.011**		
Communication	Technical	500	.27	.318	.014	916.927	.000
	General	485	.93	.135	.006		
	General and Technical	15	1.00	.000	.000		
	Total	**1000**	**.60**	**.410**	**.013**		
Applied Programmes	Technical	500	.75	.272	.012	205.503	.000
	General	485	1.00	.000	.000		
	General and Technical	15	1.00	.000	.000		
	Total	**1000**	**.88**	**.228**	**.007**		
Maintenance	Technical	500	.91	.278	.012	26.254	.000
	General	485	1.00	.000	.000		
	General and Technical	15	1.00	.000	.000		
	Total	**1000**	**.96**	**.201**	**.006**		

Table 5.12 shows that the mean difference is not significant for four taught computer studies programme components namely, programming, communication, applied programmes and maintenance between schools offering general education, and those offering general and technical at the same time (sig.>0.05). the same observation is verified for maintenance in technical education and in schools offering technical and general education.

TABLE 5.12: MULTIPLE COMPARISONS BETWEEN MEANS DIFFERENCES OF THE TAUGHT COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF EDUCATION (STUDENTS' DATA)

Components of the computer studies programme	(I) Type of education	(J) Type of education	Mean Difference (I-J)	Std. Error	Sig.
Programming	General	General and Technical	-.089	.039	**.077**
Communication			-.069	.064	**.561**
Applied Programmes			.000	.050	**1.000**
Maintenance			.000	.051	**1.000**
	Technical		-.090	.051	**.217**

*. The mean difference is significant at the 0.05 level.

In Table 13, the indexes computed for teachers' responses on the taught computer studies programme components with the variable type of education are all significant.

TABLE 5.13: GLOBAL INDEX FOR THE TAUGHT COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF EDUCATION (TEACHERS' DATA)

Computer Studies Programme Components	Type of Education	N	Mean	Std. Deviation	Std. Error	F Values	Sig.
Basics	Technical	199	.74	.412	.029	10.446	.000
	General	38	1.00	.000	.000		
	General and Technical	13	1.00	.000	.000		
	Total	**250**	**.79**	**.383**	**.024**		
Programming	Technical	199	.83	.341	.024	5.973	.003
	General	38	1.00	.000	.000		
	General and Technical	13	1.00	.000	.000		
	Total	**250**	**.87**	**.312**	**.020**		
Communication	Technical	199	.76	.418	.030	8.091	.000
	General	38	1.00	.000	.000		
	General and Technical	13	1.00	.000	.000		
	Total	**250**	**.81**	**.385**	**.024**		
Applied Programmes	Technical	199	.8827	.24490	.01736	5.804	.003
	General	38	1.0000	.00000	.00000		
	General and Technical	13	1.0000	.00000	.00000		
	Total	**250**	**.9067**	**.22346**	**.01413**		
Maintenance	Technical	199	.7990	.35859	.02542	7.956	.000
	General	38	1.0000	.00000	.00000		
	General and Technical	13	1.0000	.00000	.00000		
	Total	**250**	**.8400**	**.32990**	**.02086**		

A complementary analysis showed in Table 5.14 that the mean difference is not significant for all the five computer studies programme components in relation to the type of education (sig.>0.05).

TABLE 5.14: MULTIPLE COMPARISONS BETWEEN MEANS DIFFERENCES OF THE TAUGHT COMPUTER STUDIES PROGRAMME COMPONENTS BY TYPE OF EDUCATION (TEACHERS' DATA)

Components of the computer studies programme	(I) Type of education	(J) Type of education	Mean Difference (I-J)	Std. Error	Sig.
Basics	General		,000	,119	**1,000**
Programming	Technical		-,166	,088	**,168**
	General	General and	,000	,098	**1,000**
Communication	Technical	Technical	-,236	,107	**,090**
Applied Programmes	General		-,11725	,06277	**,177**
Maintenance	General		,00000	,10316	**1,000**
	Technical		-,20101	,09191	**,094**

*. The mean difference is significant at the 0.05 level.

Comparing the taught computer studies programme components with the type of education using both students' and teachers' data, it can be seen that there is a significant difference between secondary schools for basic computer studies programme components. This difference is not significant for general education schools and schools offering two types of education, according to teachers.

VI. DISCUSSION OF FINDINGS

The findings of this study showed that the nature of the computer studies programme in Cameroon secondary schools varies significantly according to the socio-economic area, the school typeand the type of education. In effect, computer teachers in this study are the programme implementers, and as such, they try to appropriate and implement the programme under the prevailing forces that influence what is taught (Tambo, 2012). Teachers adapt to school conditions such as the equipment, facilities, enrolment size, local characteristics, and organisational factors.

The study has found that there existed a technological devide between schools in the same administrative regions and localities. Furthermore, the enrolment size has a significant bearing on the implementation of the computer studies programme. A gap exists between public vs. private schools, rural/suburban regions vs. urban schools, and between technical and general schools.

Implementing the computer studies programme in Cameroon secondary schools, while imparting scientific and technological skills, promotes "educational inequity". The findings have demonstrated a significant difference between the taught programme with regard to socio-economic area, and type of school. Furthermore, students from poor socio-economic areas, those of public schools and those from general education, tend to be left aside as computer studies are concerned.

Findings of this study have equally confirmed that, as far as technology education is concerned, the socio-cultural context of learning in the information age, and changes in cultural practices entailed by the on-going computer processes, have considerable implications for compulsory and post-compulsory education, as stated by Leask (2001). As we have observed, and heard from teachers and students as they interacted with computer, it is evident that teaching and learning with this tool need to be reconceptualised for the 21st century. This starts with the role of teachers as programme implementers and the redefinition of the nature of the computer studies programme.

The methods and types of interaction computer teachers use to deliver the content of the computer studies programme also have an impact on the content and quality of the curriculum implemented. This research found that some methods such as lecture, were in contradiction with the teaching in secondary schools in general, and the teaching of computer and other technology oriented subjects in particular. In this vein, stressing on the importance of conceptualising and rationalising teaching, Tambo (2003) explained that the teaching act is technical and is governed by the skillful development and application of appropriate methods in order to reach predefined ends. Accordingly, Leithwood (1982) described programme implementation as a process that involves reducing the differences between existing practices and practices suggested by the innovation. This researcher thinks that these principles should be carefully considered and applied in the implementation of technology oriented subjects because of their specificities. In their research, Clark and Wenig (1999) suggested that for technology- oriented programmes, the course content should be developed from the course competencies or enabling objectives and should utilize approved curriculum guides, courses of study and professional resources. This would allow developing and experimenting with new technologies and areas.

This study has revealed that computer studies content was affected by the unending evolution of technology and society's interaction with the technology. For example, in some computer rooms visited, different generations of technologywere competing side by side. This situation made the teachers and students uncomfortable when it came to use of equipment for demonstrations and applications; the reason being that the theoretical contents taught on the computer were incompatible with the characteristics of the software installed in the machines or with the technology itself. Stenhouse (1975) therefore invites practitioners to rethink and further develop new curricula for specific circumstances they are working in, through negotiation and transaction. Teachers as practitioners are expected to use their practical situational knowledge for implementation and for modifying the original models according to the demands and resources of the specific locality (Altrichter, 2005).

For the effective implementation of the computer studies programme, the role of the teacher as a curriculum implementer in the computer and information age is crucial. Defining implementation, Fullan (1981) stated that implementation is a process of putting into practice an idea, programme, or a set of activities new to the people attempting or expected to change. During the study, it has been clear that the

implementation process results in a change in practice on the part of teachers and students and thatchange affects outcomes. This is so because the interpretation of the curriculum depends upon the teachers' stock of knowledge and beliefs about how students learn, what society wants, what the future will be like and the teachers' understanding of the organisational context of their work (Aoki, 1983). Because implementation is a human activity, the teacher is expected to teach a new programme in the classroom, while working within a complex social system. During this process, change will likely occur in an interactive way, both in the teacher, and in the innovation (Wayne and Miller, 1990). The findings have shown that in Cameroon secondary schools, teachers and students were still struggling to immerse in the process of implementing computer education in adverse structural and organisational conditions. This may be due to the fact that preparatory phases for the implementation in secondary schools did not take place effectively. As reported in the introductory background section of this article, computer education was widespread in the secondary education curriculum without a systematic plan for curriculum content, teachers and students' readiness, infrastructure and management.

VII. Conclusions and Recommendations

A. Conclusions

The study investigated the content of computer programme taught in secondary schools in Cameroon, a comparative study of the differences in the content taught by school type, type of education and socio-economic environment. Findings revealed that:

Firstly, the socio-economic environment, the type of school and the type of education affect the computer studies programme implemented in secondary schools.

Secondly, sub-urban and rural secondary schools do not differ significantly as far as the computer studies programme is concerned.

Thirdly, schools offering general education and those offering general and technical education in the same premises do not significantly differ in terms of the programme implemented for computer studies.

Factors affecting the implementation were identified, as well as, characteristics of secondary schools with respect to their stage of computer studies implementation.

1) Factors Affecting the Implementation of Computer Studies Programme In Cameroon Secondary Schools

The factors influencing the implementation of the computer studies programme in Cameroon secondary education are fourfold: school factors, people's factors, the programme features and the strategies deployed for the implementation. Fig. 7.1 illustrates these factors (Nguiamba, 2021).

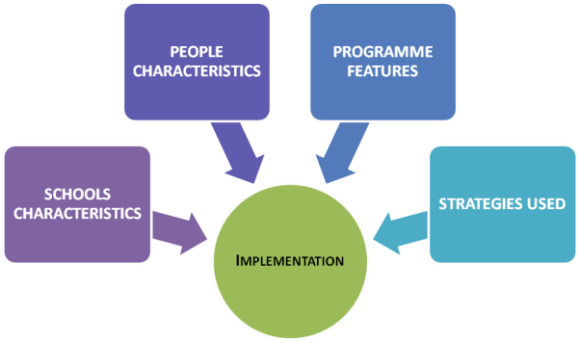

Fig. 7.1.: Typology of factors affecting the implementation of the computer studies programme in cameroon secondary schools (Nguiamba, 2021)

The description of these factors is shown in Fig.7.2.

SECONDARY SCHOOL'S CHARACTERISTICS

Social environment
- Urban area
- Sub-urban area
- Urban area

Type of School
- Public school
- Private school

Type of education offered
- General education
- Technical education
- General and Technical education

PEOPLE CHARACTERISTICS
- School leadership
- Teacher professionalism
- Student willingness to learn

COMPUTER STUDIES PROGRAMME
- The Features of the Computer Studies Programme
- Sources
- Content
- Delivery context
- Delivery methods and techniques

IMPLEMENTATION STRATEGIES
- Planning and preparation strategies
- Infrastructure and readiness strategies
- Training strategies
- Motivational strategies
- Sustainability and maintenance strategies
- Evaluation strategies.

Fig. 7.2.: Factors affecting the implementation of the computer studies programme in cameroon secondary Schools (Nguiamba, 2021)

2) Characteristics of Schools With Regards To Computer Studies

In relation to computer studies infrastructure and its management, 3 categories of schools emerged in relation to the state of computer infrastructure used for

the implementation of the official computer studies programme (Nguiamba, 2021).

"*Category A"* secondary school comprises schools that meet these four criteria: (1) a stable computer infrastructure, (2) an effective administrative management of computer laboratories, (3) an effective use of these computers in teaching, and (4) a complete phase of computer development. Stable here means that computer infrastructure was functional for effective teaching and learning. Effective management implies that the computer facilities and equipment of the school should be functional and effectively maintained for optimum use. Effective use of computer in teaching is the capacity of the school to organise regular and free computer practice for students and teachers. For example, participation in computer studies seminars, community involvement, competitions and technology fairs. This category additionally includes schools that had passed through at least two of the main phases: foundation phase, intermediate phase and senior phase of computer development. Secondary schools that could fulfil these conditions were usually found in urban and in sub-urban areas, managed by private owners or by the Government.

"Category B" secondary schools were schools with unstable or incomplete computer infrastructure and ineffective management of this infrastructure. This implies that computer equipment somehow existed, but was not as functional as expected because of lack of infrastructure to run the computer rooms. Ineffective management here means that there is no adequate management of computer equipment. Schools in "category B" lacked in resources for computer studies development (human, financial, physical), or in internal policy (planning, preparation, funding, maintenance, review and evaluation). This category of schools may be found in rural, urban or suburban areas.

"Category C" secondary schools were those without necessary physical infrastructure or equipment to effectively implement the computer studies programme. These secondary schools also lack human resources; -or the human resources may be available, but may not be adequately used due to local infrastructural constraints. Schools of this category were usually found in rural, sub-urban or in urban.

VIII. RECOMMENDATIONS

1. The pedagogical supervision of the computer studies discipline should be a subject of national reflection. It should take into account the requirements of this specialty extremely dependent on technological advancements.
2. Subject-teachers should be involved in programme development and evaluation so as to improve the implementation of computer studies in Cameroon secondary schools.
3. To supplement the shortage of computer teachers, alternative strategies could be experimented. For example, a dedicated group of itinerant teachers, designated by the Ministry of secondary education could move periodically in no or less technology privileged areas. These itinerant computer teachers could be provided with Multimedia Vans(MMV) or Multimedia Caravans(MMCV) provided with the necessary teaching and learning tools, materials and equipment used in secondary school Multimedia centres (MMC). These itinerant computer teachers would deliver the computer studies content to enable students in remote localities.
4. At the regional level, a number of strategies could be put in place to enhance the implementation of the computer studies programme. This could be the acquisition and licensing of adequate software for schools, the creation of teachers' networking and working groups, and the assessment of regional instructional environment in terms of computer facilities, in order to enable the collective use of the existing resources by a greater number of schools. Computer teachers and such equipment will therefore be available not for a single school, but for a group of schools in a given locality.
5. At the local level, the "mutualisation"(collective use) of computer resources available in a community could enhance the implementation of computer studies where teachers, infrastructure and equipment and other resources are not present. For example, the council administration may create multimedia centres as they also create libraries, museums or party and ceremony halls, to be used by their populations. These computer facilities will serve for schools which cannot afford the management of such infrastructure.

Where technological infrastructure does not permit the implementation of computer studies, students could alternatively be exposed to subjects relevant to their social, economic and cultural environment. The Cameroon socio-cultural and economic context presents interesting and relevant learning experiences and resources. Each secondary school operates in a context where numerous interesting learning opportunities exist. So, in their specific environments, students can develop their individual potentialities and, by so doing, develop their respective community economically and culturally. Such education projects and experiences could be more accessible, effective, equitable and sustainable.

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