Curriculum Implementation: A study in Two Secondary Schools in Kenya.

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ABSTRACT

The purpose of this study was to investigate how the biological science curriculum was being implemented at the secondary school level in Kenya under the 8-4-4 system of education. In this study, the case method was used to investigate implementation in two secondary schools in Baringo district, Kenya. Data were collected using observation, interviews, questionnaires, and audio recordings.

Implementation standards were found to be rather low because of a number of factors. The general laboratories in the two schools of the study were poorly equipped, and textbooks available to students were too few. Moreover, the textbooks were reported as being shallow and sketchy. In addition, the content of some topics was too difficult especially at the lower secondary (Forms I and II) level. The syllabus was also too wide for satisfactory coverage in the four-year duration of secondary education.

An additional problem found was that there were no in-service courses for the biology teachers. It was also found that the head teachers played a limited role as instructional supervisors because most of their time was spent on administrative duties.

RESUME

Le but de cette étude consistait à étudier de quelle façon un programme en sciences biologiques pouvait être implanté au niveau secondaire au Kenya dans une structure scolaire du type 8-4-4. Dans cette étude, l'analyse de cas fut utilisée afin d'étudier cette implantation dans deux écoles du district scolaire Baringo Kenya. Le données furent recueillies à l'aide d'observations, d'entrevues, de questionnaires et de'enregistrements sonores.

Les normes d'implantation se sont révélées plutôt faibles à cause d'un certain nombre de facteurs. Les laboratoires généraux des deux écoles étaient mal équipés et les manuels scolaires étaient peu nombreux. D'ailleurs, les manuels scolaires étaient superficiels et rudimentaires. De plus, le contenu de certaines matiéres était trop vaste pour couvrir d'une façon suffisante les quatre années du cours secondaire.

L'étude a également révélé qu'il n'existait aucun cours de perfectionnement à l'intention des professeurs de biologie et que les enseignants responsables jouaient d'une façon limitée leur rôle de supervision parce qu'ils passaient la majorité de leur temps à des tâches administratives.

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Finally and regretably, I would like to dedicate this thesis to my beloved mother, KABON whose demise I learned of when I was putting the final touches on this thesis. May God rest her soul in eternal peace.

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1.0 STATEMENT OF THE PROBLEM.

1.1 INTRODUCTION.

The purpose of the present study was to investigate how the biological science curriculum was being implemented at the secondary school level under the new 8-4-4 system of education in Kenya. The study explored some of the problems faced by the teachers in the two sample schools as they tried to implement the biological science curriculum.

The 8-4-4 system was adopted nationwide in January 1985. The technical and practical orientation of the system called for additional infrastructure which in turn posed a great challenge to the public in constructing and equipping science laboratories, Home science blocks, and Agriculture workshops in secondary schools. An equally heavy burden was placed on the government to provide trained teachers especially for the sciences and technical subjects. Demand was heavy especially in the "Harambee" (community) and government-assisted secondary schools. The present chapter lays a background to the study. It is divided into the following parts:

1) Types of secondary schools in Kenya
2) The expansion of education at the primary and secondary

school levels after independence

3) Expenditure on education after independence

4) Major reviews of Kenya's education system

5) Rationale for the 8-4-4 system of education

6) Rationale for the study

1.2 TYPES OF SECONDARY SCHOOLS IN KENYA.

There are four categories of secondary schools in Kenya: government-maintained, government-assisted, "Harambee", and private. Government-maintained schools receive grants to augment the money collected from fees. These funds are used to maintain school buildings, meet transport costs, pay salaries for school employees, and purchase school supplies such as laboratory apparatus, chemicals, textbooks, and stationary (Maundu, 1986). The government also posts teachers to these schools through the Teachers' Service Commission (TSC). The majority of these teachers are professionally trained.

Harambee secondary schools are built, financed, and managed by local communities in response to the continuous shortage of places in government schools. Often, the communities organize public fund-raising meetings to solicit donations from local and national politicians, firms, and individuals in the spirit of "Harambee" (meaning let's pull together). Harambee is a term used to refer to a spirit of

self-help in performing community-based development projects such as raising funds towards the building of schools, hospitals, and churches, and towards the provision of other social amenities. Harambee is a highly popular and accepted concept in Kenya.

If a Harambee school meets the standards for school facilities set by the School Inspectorate, it can receive assistance from the government in the form of trained teachers including a headmaster or a headmistress. In addition, it also receives some financial grant in aid. For this reason, such institutions are referred to as government-assisted or Harambee-assisted secondary schools. In order for a harambee school to obtain government aid, it should first "muster enough resources on its own..." (Keller, 1975. p.4).

The fourth type of secondary school is the private school. These are owned and managed by individuals and voluntary organizations. They do not get aid in any form either from the government or the public. It should be noted, however, that for the first three categories of schools, the government has recommended that they be designated public schools since they are developed, equipped, and provided with staff from public funds by the government, parents and communities (Republic of Kenya, 1988). In broad terms therefore, there are two categories of secondary school, namely public and private.

There are differences among the school types mentioned above with regard to such aspects as school facilities and the availability of qualified personnel. Such differences are particularly noticeable between government schools and the Harambee and private schools. In 1979, for example, 84% of all teachers in government-maintained schools were professionally qualified, compared to 45% and 22% in assisted and Harambee schools respectively. In 1984, 88% of all the teachers in government-maintained schools were university graduates compared to 18% in both the assisted and Harambee schools (Mwiria, 1990, p.362). Generally, government-maintained secondary schools are better equipped than government-assisted secondary schools. Invariably, many Harambee secondary schools are ill-equipped. A few of the private schools are among the best in the country and compete favourably with government-maintained schools in their performance on the Kenya Certificate of Secondary Education (KCSE) examinations. Many others are, however, worse than Harambee schools in terms of school facilities and teachers' academic and professional qualifications and also in their performance on the national examinations.

1.3 EXPANSION OF EDUCATION.

The number of schools, pupils, and teachers has grown tremendously since independence, especially at the primary

and secondary school levels. Table 1.1 illustrates this increase in primary education in 23 years of independence from 1963 to 1986.

TABLE 1.1

PRIMARY EDUCATION: GROWTH OF SCHOOLS, ENROLLMENT, AND TEACHERS, 1963-1986.

YEAR	SCHOOLS	PUPILS	TEACHERS		
			TRAINED	UNTRAINED	TOTAL
1963	6,058	891,553	17,682	5,045	22,727
1964	5,150	1,014,719	19,179	8,649	27,827
1965	5,078	1,020,889	20,112	10,480	30,592
1966	5,699	1,043,416	23,305	10,217	33,522
1967	5,939	1,133,179	25,050	10,622	35,672
1968	6,135	1,209,680	27,485	10,438	37,923
1969	6,111	1,282,297	30,001	8,311	38,312
1970	6,123	1,427,589	32,929	8,550	41,479
1971	6,372	1,525,498	37,617	11,779	49,396
1972	6,657	1,675,919	41,599	11,937	53,536
1973	6,932	1,816,017	43,990	12,553	56,543
1974	7,668	2,705,878	52,132	26,208	78,340
1975	8,161	2,881,155	54,823	31,284	86,107
1976	8,544	2,894,617	56,154	32,929	88,083
1977	8,896	2,974,849	59,640	30,124	89,764
1978	9,243	2,994,892	63,912	28,234	92,046
1979	9,622	3,698,196	68,361	29,401	97,762
1980	10,268	3,926,629	72,029	30,460	102,489
1981	11,127	3,980,763	76,499	34.412	110,921
1982	11,497	4,184,602	80,664	34,430	115,094
1983	11,856	4,323,921	84,036	35,673	119,709
1984	12,539	4,380,232	86,135	36,641	122,776
1985	12,936	4,702,414	96,586	41,799	138,385
1986	13,392	4,843,423	99,680	43,127	142,807

Note: Number of schools dropped in 1964 due to the amalgamation of primary and intermediate schools.

Source: Ministry of Education, Kenya (1984, p.140).

Primary school enrollment expanded greatly from 891,553 pupils in 1963 to about 5,123,600 in 1988 (Republic of Kenya, 1989, p.138-150), an increase of over 500%. The number of primary schools increased from 6,058 to 13,392 during the same period, representing an increase of 121.1%. It is projected that primary school enrollment will hike up to over 7 million pupils by the year 2000 (Republic of Kenya 1990, p.8). The number of trained primary school teachers increased from 17,662 in 1963 to 99,680 in 1986, an increase of 463.7%. Untrained primary school teachers increased from 5,045 in 1963 to 43,127 in 1986, an increase of 754.9%.

Secondary education also showed an impressive expansion (as illustrated in Table 1.2) from 30,121 students in 1963 to 458,712 in 1986, an increase of 1,422%. It is projected that the enrollment at the secondary school level will rise to over 1 million students in the year 2000 (Eshiwani, 1989, p.122). Secondary schools increased from 151 in 1963 to 2,485 in 1986, an increase of 1,545.7%. Trained secondary school teachers increased from 1,098 in 1963 to 13,263 in 1986, an increase of 1,107.9%. Untrained secondary school teachers increased from 504 in 1963 to 9,033 in 1986, an increase of 1,692.3%.

TABLE 1.2

SECONDARY EDUCATION: GROWTH OF SCHOOLS, ENROLLMENTS, AND TEACHERS, 1963-1986.

YEAR	SCHOOLS	ENROLLMENT	TEACHERS		
			TRAINED	UNTRAINED	TOTAL
1963	151	30,121	1,098	504	1,602
1964	336	35,921	1,140	510	2,650
1965	386	47,976	1,866	628	2,494
1966	400	63,193	2,160	844	3,004
1967	542	88,779	2,470	1,583	4,053
1968	601	101,361	2,742	1,902	4,644
1969	694	115,246	3,721	1,996	5,717
1970	783	126,855	3,681	2,200	5,881
1971	809	140,722	3,907	2,464	6,371
1972	949	162,920	4,469	2,637	7,106
1973	964	174,767	4,750	2,638	7,388
1974	1,019	195,832	4,816	2,753	7,569
1975	1,160	226,835	5,558	3,631	9,189
1976	1,268	280,388	6,460	4,978	11,438
1977	1,473	320,310	6,714	5,967	12,681
1978	1,721	361,622	7,728	6,938	14,666
1979	1,773	364,389	7,908	7,396	15,404
1980	1,785	399,389	7,554	8,090	15,644
1981	1,904	409,850	7,902	9,175	17,077
1982	2,131	438,344	8,227	9,571	17,848
1983	2,230	493,710	8,797	10,163	18,960
1984	2,396	510,943	10,720	8,648	19,368
1985	2,413	401,978	12,552	9,160	21,712
1986	2,485	558,712	13,263	9,033	22,296

Source: Ministry of Education, Kenya (1984 p. 145).

The mushrooming of Harambee secondary schools has contributed mainly to the massive expansion of secondary school education. A number of factors has made this possible. One is the assumption that the more education one receives the more money one would earn, which in turn would lead to better standard of living (Court and Ghai, 1974, p.34; Keller, 1975, p.2-3). Hence a community's interest in

creating secondary school opportunities for their children is stimulated by the desire to enable them improve their chances of competing favourably for the few jobs available to the educated elite.

The government's decision to slow down the rate of expansion of government secondary schools at the beginning of the 1974 to 1978 Plan Period seems to have accelerated further the proliferation of Harambee secondary schools because the public responded to the constraint by building more schools. With time, Harambee secondary schools exceeded the government schools in both numbers and enrollments. As of 1979 for example, there were 1,319 Harambee secondary schools with a total enrollment of 222,952 students compared to 418 government schools with an enrollment of 145,357 students (Mwiria, 1990, p.355).

The rapid expansion of primary school population is a third factor contributing to the establishment of Harambee schools. The shortage of secondary schools was felt as early as the 1940's and 1950's due to the expansion of primary education (Indire, 1974, p.3). Since independence (1963), the number of places in government schools has not increased fast enough to absorb the large number of primary school leavers desiring secondary education. The establishment of more Harambee secondary schools is therefore an attempt to contain the situation.

1.4 EXPENDITURE ON EDUCATION.

With the increase in pupil enrollments and teacher recruitment, an increase in educational expenditure was inevitable. Kenya spent 10.3% of its public expenditure (60 million Kenyan shillings) on education in 1964/65. Ten years later (1974/75), the expenditure on education rose to 1 billion Kenyan shillings which represented 34.5% of Kenya's public expenditure. Expenditure on education shot up to 37.7% in 1987/88 when 7.7 billion Kenyan shillings was spent on education (Republic of Kenya, 1990, p.14-15). The trend therefore depicts a situation in which a sizeable and growing percentage of government recurrent expenditure is devoted to educational budget. Table 1.3 shows the government expenditure on education as a percentage of total recurrent expenditure over a 24 year duration from 1964/65 to 1987/88.

TABLE 1.3
EDUCATION FINANCE: GROWTH IN EXPENDITURE, 1964/65–1987/88

	RECURRENT KENYAN SHILLING. "000"		
YEAR	TOTAL GOVERNMENT	EDUCATION	%
1954/65	657,046	60,056	10.3
1965/66	739,658	98,044	12.1
1966/67	820,376	115,858	14.1
1967/68	895,768	133,978	14.9
1968/69	960,724	153,682	16.4
1969/70	1,199,302	250,300	20.8
1970/71	1,389,866	409,280	29.4
1971/72	1,749,958	525,140	30.0
1972/73	2,003,744	650,998	32.4
1973/74	2,438,782	778,342	31.9
1974/75	3,139,442	1,084,310	34.5
1975/76	3,800,616	1,291,828	33.9
1976/77	4,531,616	1,423,964	31.4
1977/78	6,452,000	1,677,658	26.0
1978/79	7,439,620	1,907,470	25.6
1979/80	7,945,382	2,293,936	28.8
1980/81	10,120,228	2,997,074	29.6
1981/82	11,006,004	3,298,184	29.9
1982/83	11,658,030	3,548,606	30.4
1983/84	12,251,660	3,671,084	29.9
1984/85	14,825,570	4,429,154	29.8
1985/86	16,529,646	5,926,843	35.8
1986/87	18,593,876	6,760,134	36.4
1987/88	23,338,193	7,711,678	37.7

Note: These exclude figures for Adult Education and Training which stood at about 12% in 1987/88.

Source: Ministry of Education, Kenya (1990, p.15).

Heyneman (1984) has remarked in regard to financing education in developing countries that "over nine-tenths of the investment has to be allocated to teachers' salaries" (p.2). Kenya spends nearly 40% of her recurrent budget on education. Approximately 90% of the budget on primary education goes to pay teachers' salaries, 70% of the

secondary education budget and 60% of that of university education pays for the teachers' and lecturers'/professors' salaries respectively (Heyneman, 1984). This means that a very small proportion of the education budget is used to improve instructional conditions, e.g teacher pre-service and in-service training, provision of physical facilities such as classrooms, laboratories and workshops and for the purchase of teaching and learning materials such as laboratory equipment, textbooks, charts, and models. This is bound to have far reaching implications, perhaps of a negative nature on the process of implementation of a new programme such as the 8-4-4 biological science curriculum.

1.5 MAJOR REVIEWS OF KENYA'S EDUCATION SYSTEM.

Kenya's formal education has its roots in the activity of European missionaries during the seventy years of colonial rule. During this period education was "infused with British content, practice and ethos" (Eshiwani, 1983, p.20). Further, the administration of the education system was segregated along racial lines (European, Asian, and African) until 1960 when Asian and African children were admitted into European secondary schools for the first time. The admission of Asian and African children into European primary schools occurred two years later (Stabler, 1969, p.20).

Despite the fact that Africans constituted the majority of Kenya's population (97% in 1953), their representation in education, particularly in post-primary schooling was very low (Stabler, 1969, p.21). For example, in 1962, out of 25,903 students (European, Asian and African) in secondary schools, only 8,033 (31%) were Africans (Eshiwani, 1983, p.21). The European and Asian populations which represented approximately 3% of the total population had a high proportion (69%) of students in secondary schools. The situation was virtually the same at independence a year later. By this time there was a great demand for indigenous skilled manpower in various government ministries as well as in the private sector.

On achieving independence in 1963, Kenya sought ways of changing the inherited colonial system. The aim was to make the education system more supportive and responsive to the newly developed national goals (Merrifield, 1986, p.66, Sifuna, 1984, Republic of Kenya, 1985, p.5).

An education commission was, therefore, set up immediately after independence. Its aim was to review and explicitly define educational policy for the nation. This commission, the Kenya Education or Ominde Commission (1964) outlined a number of national objectives for education which continue to guide educational policy. The objectives were:

a. to promote national unity;

b. to serve the people of Kenya and the needs of the

country without discrimination;

c. to respect the religious convictions of all people;

d. to respect the cultural traditions of all people;

e. to make every one realize that they have a valuable part to play in nation building;

f. to use education as an instrument for positive change of attitudes in line with modern times regarding productive organizations while at the same time respecting human personality;

g. to serve the needs of national development; and

h. to promote social equality and train people regarding social responsibility and obligation;

(Republic of Kenya, 1964, p.25).

The major impact of the 1964 commission was the expansion of schooling resulting in the provision of universal primary education.

Since independence, educational policies have been guided by other commissions as well, notably the National Commission on Educational Objectives and Policies (NCEOP) of 1976 and the Presidential Working Party on the Second University (1981). The reports of these two commissions are commonly referred to as Gachathi and Mackay respectively after the names of the chairmen who headed the inquiries. The purpose of these commissions has been to "look into ways and means of achieving the national objectives" mentioned

above (Republic of Kenya, 1984, p.v). The 1976 commission addressed unemployment among secondary school leavers. Manpower requirement issues were also addressed. A major outcome of the 1981 report was the establishment of a second university in Kenya (now Moi University). It also led to the reorganization of the educational system into an 8-4-4 pattern. Table 1.4 shows the years spent in school and the subjects offered under the old 7-(4-2)-3 system and the new 8-4-4 structure.

TABLE 1.4

STUCTURE OF THE EDUCATION SYSTEM: COMPARISON OF THE 7-(4-2)-3 AND THE 8-4-4 SYSTEMS

	7-(4-2)-3 SYSTEM		8-4-4 SYSTEM	
Educ. Level	Years	No. of Subjects	Years	No. of Subjects
Primary	7	11	8	16
Secondary	4+2	13	4	20
University	3	13	4	15
Total	16	37	16	51

From Table 1.4, one notes that the 8-4-4 system is more demanding in that it offers many more subjects at the primary, secondary and university than was the case with the old 7-(4-2)-3 system.

1.6 RATIONALE FOR THE 8-4-4 SYSTEM OF EDUCATION.

The essential elements of the 8-4-4 system are in its structure which has 8 years of primary, 4 years of secondary, and 4 years minimum university education, and in curriculum content with greater orientation towards technical education (Republic of Kenya, 1984). The 8-4-4 structure which is based on the North American model replaced the older system whose structure was 7 years of primary, 4 years of secondary, 2 years higher, and a minimum 3 years university education. The latter structure was based on the British model.

In the context of the present study, the importance of the 8-4-4 system does not lie in its structure since the number of years spent in school remained the same as before (16 years). It is the curriculum content that is of more importance here. Previous reports on education indicated that the old system of education did not respond to the needs of the country and its people because it was geared towards white collar jobs. It was therefore felt that there was need for a more relevant curriculum through the

provision of a practical-oriented content that would offer a wider range of employment opportunities. This need prompted the creation and subsequent adoption of the 8-4-4 system with an added emphasis on technical and science subjects.

Under the 8-4-4 system, primary school pupils who can not proceed to secondary can enter the Craft Training Centres (Village polytechnics) from where they can continue to the post-secondary training institutes for diploma courses. This is intended to ensure that funds invested in education are not lost through dropouts who had neither useful education nor the opportunities to improve on what had already been gained. The scientific and technological education provided at the higher levels of education under the 8-4-4 system would provide highly skilled and specialized manpower in such areas as engineering, agriculture, medicine, architecture, botany, and, zoology (Republic of Kenya, 1984).

The old structure was further accused of its tendency to concentrate on imparting knowledge for the sake of passing examinations. "... The system took no or little consideration of a student's progressive growth in school. It relied mainly on rote learning and memorization" (Republic of Kenya, 1984, p.v). Another weakness of the old system lay in its 2-year "A" level segment. The division of students into Arts and Science streams at the "A" level resulted in too early a specialization. At the university,

some faculties found it necessary to cover afresh those parts of the foundation topics which should have been adequately taught in the "A" level. It was also noted that the 3 year period spent by students in the university was too short and could not enable a student to be exposed to the necessary training for life which university education is expected to impart (Republic of Kenya, 1984). The three years merely allowed for instruction in a narrow field of specialization. An extra one year was therefore added under the 8-4-4 structure making it four years for a basic university degree. One year would be spent being exposed to a wider programme of study during which students would decide on what specialization to pursue (Republic of Kenya,1984).

Under the old system, the "A" level section was widely perceived by both students and parents as a point of entry to university education. Because of the importance attached to this, both the government and public expanded "A" level facilities in order to prepare as many students as possible for selection to the university. Since it was less expensive to set up and run "A" level Arts streams than science ones, too many of the former sprung up in many parts of the country. Many students including those with weak "O" level results could then be admitted to "A" level. This gave a false hope to far too many Arts students regarding their potential capacity for university education. This was

frustrating since only a few of them could actually be admitted. The 8-4-4 system of education was therefore introduced in 1985 with the aim of redressing this and other shortcomings of the old system. Accordingly, the "A" level segment was removed and the 8-4-4 curriculum was diversified.

1.7 THE 8-4-4 CURRICULUM.

The main aim of the primary cycle of the 8-4-4 system is to provide children with adequate intellectual and practical skills useful for living in both urban and rural areas (Republic of Kenya, 1984). To achieve this, the following subjects are offered in the primary curriculum: English, Kiswahili (national language), Mathematics, Science (including Agriculture), Home science, Art and Craft, Music, History and civics, Geography, Religious education and Physical education.

Through the teaching of practical subjects like Art and Craft, Home science and Agriculture pupils are expected to acquire practical skills. In Agriculture for example, the following practical activities are emphasized:

1) growing of crops like vegetables and flowers for use and sale;
2) rearing of domestic animals;
3) poultry and bee keeping;

4) caring for the soil and the environment; and

5) making farm tools

(Republic of Kenya, 1984, p.4).

In Home science, special attention is given to topics which will prepare pupils in needlework, food preparation, child care, and care of the home (Republic of Kenya, 1984).

Major objectives of the 8-4-4 secondary cycle include enabling the learners to choose with confidence and cope with vocational education after school. In addition, it is intended to build a firm foundation for further education (Republic of Kenya, 1984). To achieve this a diverse curriculum is offered at the secondary cycle: English, Foreign languages (French and German), Mathematics, Physical sciences, Biological sciences, Religious education, Agriculture, Home science, Business education, Technical education, Art, Music, Social ethics, and Physical education.

At the university, basic degree courses of study covering four years are offered. Specialized courses like Medicine and Architecture take longer periods. The overall aim is to develop and transmit knowledge and skills through research and training at undergraduate and postgraduate levels (Republic of Kenya, 1984, p.8). In a nutshell, the disciplines offered in the four national universities are: Agriculture, Architecture, Design and development, Commerce, Arts, Engineering, Medicine, Veterinary medicine, Science,

Education, Forest resources and Wildlife Management Science, Information Science, Social, Cultural and Development Studies and Continuing Education. For comparison Table 1.5 shows the curriculum offered at the primary, secondary, and tertiary levels under the former 7-(4-2)-3 and new 8-4-4 systems of education.

TABLE 1.5 COMPARISON OF THE PRIMARY, SECONDARY AND UNIVERSITY CURRICULAR PROGRAMS UNDER THE 7-(4-2)-3 AND 8-4-4 SYSTEMS OF EDUCATION.

7-(4-2)-3 SYSTEM	8-4-4 SYSTEM
PRIMARY 1-7	**PRIMARY 1-8**
Mother tongue	Mother tongue
Kiswahili	Kiswahili
English	Mathematics
Geography	Science
Art and Craft	Art
Science	Craft
History and Civics	Home science
Mathematics	Music
Music	Geography)
Religious education	history)
Physical education	& civics
	religious education
	Pastoral programme
	Physical education
	Business education
	Art & Craft
7-(4-2)-3 SYSTEM	**8-4-4 SYSTEM**
SECONDARY 8-11	**SECONDARY 9-12**
English	English
Mathematics	Mathematics
Kiswahili	Kiswahili
Physical sciences	Foreign Languages
Biological sciences	Physical sciences
Geography	Biological sciences
History	Geography
Religious education	History & Government
Agriculture	Religious education
	Social education & Ethics
	Agriculture
	Wood technology
	Electrical technology
	Metal work
	Accounts
	Commerce
	Typing & Office practice
	Clothing & Textiles
	Foods & Nutrition
	Physical education

TABLE 1.5 CONTINUED

7-(4-2)-3 SYSTEM	8-4-4 SYSTEM
A-LEVEL 12-13 Students specialized in Arts or Science and took any of the following subject combinations: **SCIENCE.** Physics, Chemistry, Biology Maths, Biology, Chemistry Maths, Physics, Chemistry Maths, Biology, Geography General Paper **(COMPULSORY)** for all students. **ARTS** Kiswahili, Geography, Economics Maths, Divinity, Economics Kiswahili, Literature, Economics Literature, Divinity, History History, Literature, Economics Maths, Geography, Economics Literature, Geography, Economics History, Kiswahili, Economics Kiswahili, Literature, Economics LIterature, Geography, History Kiswahili, Literature, Divinity General Paper **(COMPULSORY)** for all students.	**NO A-LEVEL IN 8-4-4 SYSTEM**
UNIVERSITY 14-16 Agriculture Architecture Design & Development Arts Commerce Engineering Medicine Veterinary medicine Science Education Continuing Education African studies Journalism	**UNIVERSITY 13-16** Agriculture Architecture Design & development Arts Commerce Engineering Medicine Veterinary medicine Science Education Continuing education Computer science Journalism Forest Resources and Wildlife Management Science

Source: Republic of Kenya (1984, p. 4-11)

It is clear from the Table that the curriculum offered under the new system is broader than that offered in the old system. This places a substantially heavier load on the students in the new system. For instance, while a Form IV student in the old system had to sit a minimum of 6 subjects at the end of the 4 year secondary cycle, his or her counterpart under the 8-4-4 system must take a minimum of 10 subjects. In the same vein, standard 7 pupils sat a one-day examination at the end of the primary cycle in the old system but they now sit a more intense three-day examination under the new 8-4-4 structure.

The 8-4-4 system with its emphasis on technical and vocational education is aimed at ensuring that the students graduating at each level have some scientific and practical knowledge that can be utilized for self-employment, salaried employment, or further training (Republic of Kenya, 1990, p.2). Appendix A shows the possible flow of students through the primary, secondary and tertiary cycles in the 8-4-4 system of education. A possible flow of students through the three educational levels in the former 7-(4-2)-3 system is also included in Appendix B for comparison purposes. From the two diagrams, one notes that there are more possible options under the 8-4-4 structure than there were in the former system especially for primary and secondary school graduates. In the old system, the primary cycle led to a more or less dead end both educationally and in terms of

work for those who did not proceed to secondary school.

1.8 RATIONALE OF THE STUDY.

With the tremendous expansion of education particularly at the primary and secondary school levels, the government and the communities are faced with serious challenges to provide the necessary resources for education. The demand for trained teachers, physical facilities, textbooks and laboratory equipment is ever on the increase. Increasingly colossal amounts of money are therefore spent to finance education. Due to the country's poor economy it is quite difficult to face the demand posed by this rapid expansion of education.

As noted above, the curriculum under the 8-4-4 system of education is even more challenging and more demanding because new subjects have been added. Such subjects include; Home science, Art and Design, Agriculture, Woodwork, Metalwork, Building construction, Accounting, and Music. These new subjects call for teachers who have undergone some professional training. But due to the unavailability of teachers and facilities for these specialized subjects, only a few schools (more established ones) offer these courses. There is therefore the option to offer or not to offer some of these subjects.

The situation is, however, different in the case of

biological science in that the subject is compulsory in all the secondary schools regardless of whether they are in a position to teach it satisfactorily. Although the subject had been in existence under the previous 7-(4-2)-3 system of education, secondary schools offered it in different forms: Pure biology, Health science, Human biology, or General science (biology). Only those students who took pure biology were required to conduct rigorous laboratory experiments which culminated, for those students, in taking a laboratory (practical) examination in their final year of secondary education. The students in other schools were not required to do a practical examination; they did theoretical papers instead. Naturally, the more established, well equipped secondary schools opted for pure biology while the others chose the less demanding forms of biological science, since they were less prepared for pure biology.

Under the 8-4-4 system of education, it is compulsory for all the schools to offer laboratory activities in biological science which culminates in all students sitting a laboratory (practical) examination at the end of the secondary cycle. This calls for an acquaintance with the use and handling of laboratory apparatus and the ability to make keen observations and draw valid conclusions. As noted earlier, differences exist among the four categories of schools (government-maintained, government-assisted, Harambee, and private) found in Kenya with regard to school

facilities and staffing. It is therefore important to find out how the biological science curriculum is being implemented at the secondary school level under the new system.

By focusing on this, the study aimed at pinpointing the difficulties encountered during implementation and possibly making suggestions on how to improve the implementation of biological science curriculum at the secondary school level. Therefore the two major questions of the study were, how were the teachers implementing the 8-4-4 secondary cycle biological science curriculum; and what were the concerns for biology teachers and head teachers with regard to implementation.

1.9 OVERVIEW OF THE STUDY.

The implementation of the secondary school biological science curriculum of the 8-4-4 system of education was the focus of this study. The report is divided into five chapters; chapter one gives an introduction and rationale for the study, chapter two deals with current implementation literature, chapter three describes the methodology, chapter four presents the findings of the study while chapter five deals with summary, conclusions and recommendations.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE AND RESEARCH.

2.1 INTRODUCTION.

The purpose of the present study was to investigate how the 8-4-4 biological science curriculum was being implemented at the secondary school level in Kenya. The present chapter begins with a general description about educational change and what it entails. This is followed by a discussion of the factors that are likely to affect the implementation of curricular changes as reflected in the literature on implementation.

2.2 EDUCATIONAL CHANGE.

Verspoor (1989) defines educational change as "planned improvement in the educational system aimed at teaching practice, learning resources, or structure and organization with a view of enhancing student achievement" (p.4). At a general level, therefore, one might assume that educational changes are introduced because they are desirable according to certain educational values and are expected to meet a given need better than existing practices. In light of this, there have been many science reform activities aimed at a more utilitarian interpretation of science education for

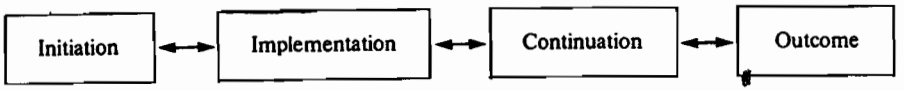
pupils in both developed and developing countries. Such reforms have occurred in Tanzania (Nyerere, 1967), Australia (Lucas, 1972), Sweden (Heidenheimer, 1978), Nigeria (Adamu, 1989), Malawi (Moss, 1974), Thailand (Sapianchai, 1984), Kenya (Republic of Kenya, 1984), and Indonesia (Shaeffer,1989).

An added dimension to the educational reform activities in both developed and developing countries (although more so in the latter), was an emphasis on labour market orientation in some of the curricular reforms, aimed at a speedier national self reliance in scientific and technological disciplines through science education. This was inspired by the view that only a comprehensive reform in science education could lead to development and self-reliance (Knamiller, 1984).

It was with the above view that Kenya reformed its education system in January 1985 by adopting the 8-4-4 system of education. This is stated clearly in the 1989-1993 Development Plan: "The courses offered in the 8-4-4 system are designed to make graduates at each level properly oriented to face realities in agriculture, small-scale enterprises, and other forms of self-employment that most of them will inevitably have to be engaged in, as opportunities for rapid generation of jobs in the modern non-agricultural sector will be critically limited (Republic of Kenya, 1990, p.212).

Most researchers (e.g Louis and Rosenblum, 1981, Berman and McLaughlin, 1978, Fullan, 1982, and Verspoor, 1989) recognize three broad phases in the change process. Phase I, variously labelled initiation, adoption, or mobilization covers the events leading up to, and including, the decision to try out an innovation. Phase II, implementation, is the process of putting an innovation into practice in the classroom. Some researchers such as Huberman and Miles (1984) have found it useful to distinguish between early and late implementation experiences. Phase III, termed continuation, incorporation, or institutionalization is the final stage in the educational change process and refers to the sustained application and integration of the innovation into regular classroom and administrative practices. At that point, the reform is no longer regarded as an innovation (Verspoor, 1989). Figure 1 below depicts the three phases and adds the concept of outcome to provide a complete overview of the change process.

FIGURE 1 A SIMPLIFIED OVERVIEW OF THE CHANGE PROCESS.



Source: Fullan (1982 p.40).

A large number of variables affects progress through the phases depicted in Figure 1 above. Progress is frequently non-linear; the beginning and the end of each phase often cannot be precisely demarcated. Nevertheless, marking change by these phases helps to bring some order in the discussion of the educational change process.

Since the present study deals with implementation, more is discussed about this phase of educational change. Implementation is both technically and socially complex. Its technical complexities are caused by the idiosyncratic nature of teaching and limited knowledge of effective ways to enhance student achievement, particularly in developing countries (Israel, 1987). Its social complexities stem from the large number of people involved in the education system and the unpredictability of their behaviour. As noted by Fullan (1982), "A large part of the problem of educational change may be less a question of dogmatic resistance and bad intentions (although there is certainly some of both) and more a question of difficulties related to planning and coordinating a multilevel social process involving thousands of people" (p.55).

The technical and social complexities of innovation in the education sector result in an implementation process fraught of uncertainty. Schon (1975) states this succinctly when he says that all real change involves "passing the zones of uncertainty... the situation of being at sea, of

being lost, of confronting more information than one can handle" (p.2). Fullan (1982) seems to agree with this view when he asserts that real change, whether desired or not, whether imposed or voluntarily pursued, represents a serious and collective experience characterized by ambivalence and uncertainty. Since any group of people possesses multiple realities, any collective change attempt will necessarily involve conflict. Change will only be effective under conditions which allow people to react, to form their own position, to interact with other implementers and obtain professional guidance.

Perhaps one of the most frustrating features of change is that it requires time. Implementing change in large organizations typically involves changing the performance of the smallest organizational unit, which, in the case of education is the school. In "loosely coupled" organizations (Weick, 1976) like education systems, this is a time-consuming process that needs to be repeated many times with considerable variation to account for specific local conditions.

In sum, it is imperative that appropriate procedures be established in the implementation strategy if change is to be effective. These include procedures to obtain needed resources at the right time and of the required magnitude; to coordinate often complex management systems (Middleton, 1987); to try out formative monitoring, research, and

evaluation; to provide time to reflect on the project's progress and possible solutions to its problems (Lewin, 1985); to train and upgrade implementing personnel and strengthen key implementing institutions (Verspoor, 1989).

In the case of the secondary cycle of the 8-4-4 system of education in Kenya, the calendar of implementation activities seems to indicate that the initial launching of the system to the implementation stage was conducted rather hurriedly. Table 2.1 shows the time line of implementation activities of the 8-4-4 secondary cycle.

TABLE 2.1

8-4-4 SECONDARY CYCLE IMPLEMENTATION ACTIVITIES

YEAR 1985	MAJOR EVENT
January/ February	. Writing workshops for syllabuses . Receiving reports of the workshops . Receiving the syllabuses . Approval of the syllabuses
March/ April	. Printing of syllabuses . Writing of syllabus course outlines
May/ June	. Outlines to schools and colleges . Orientation of field officers, heads of secondary schools, and principals of secondary teachers colleges . Development of pupil's textbooks for Forms I and II . Design and development of formative evaluation instruments begins
July	. Receiving and discussing of formative evaluation instruments
August	. In-service training of secondary school teachers and tutors of secondary teachers colleges
November/ December	. Printing of Forms I and II textbooks
December	. Dispatching of Forms I and II textbooks to secondary schools
January, 1986	. First Form I students under the 8-4-4 system of education enter secondary schools

Source: Republic of Kenya, 1984, p.25.

While the above was going on, parents and communities were being urged to provide the infrastructure and other resources necessary for the implementation of the new system. This was the busiest and the most demanding period for secondary school Boards of Governors and Parent Teachers

Associations who had to organize Harambee meetings to solicit funds for the construction of Science laboratories, Home science blocks, Agriculture workshops, and other infrastructure.

2.3 FACTORS AFFECTING IMPLEMENTATION.

Implementation consists of the process of putting into practice an idea, programme or set of activities new to the people attempting or expected to change (Fullan, 1982). Rudduck and Kelly (1976) define implementation as the process of putting ideas and materials into practice. Current literature and research within developed and developing countries consistently point to at least 5 critical variables affecting the implementation of new curricula. The variables are: 1. Resources materials; 2. In-service courses for teachers; 3. Difficulty of content and clarity of goals; 4. Teacher-teacher relations; and 5. The role of the principal.

It is reasonable to propose that in a school situation where some curriculum has to be implemented, the more factors that are working against implementation, the less effective the process can be expected to be. Conversely, the more variables supporting implementation, the more change in practice will be accomplished. The purpose of this section is to discuss current literature as it relates to the above

variables.

1. Resource materials

A resource can be defined as any person, tool, piece of equipment... that has the potential of aiding the productive process (Sirkorski et al. 1977). In one of the studies on implementation, Berman and Pauly (1975) report that inadequate materials, space and equipment were mentioned 328 times as being problems to implementation well above other factors except clarity and familiarity with goals and methods. Gross et al. (1971) identified time and inadequate materials as barriers to implementation.

A further aspect of timing as a resource is that the time perspective for adequately implementing educational innovations is unrealistically short, presumably because the complexity of the process of implementation is insufficiently understood and/or the immediacy of the need for change is too great (Charters and Pellegrin, 1973). Fullan (1982) adds that the decision makers for educational change have only the adoption perspective in mind but not an implementation one (p.68).

Unrealistic time-lines add to the burdens of implementation: materials fail to arrive on schedule, orientation and training are neglected or carried out perfunctorily, communication is hurried and frequently

overlooked or misinterpreted and people become overloaded with the requirements of new programmes on top of carrying on as usual. Disillusionment, burnout, cynicism, and apathy come to characterize many people's orientation to every change that comes along (Yin et al. 1977). And yet open-ended time-lines are also problematic, because they create ambiguity about what is expected and when it is expected. A time-line which is neither unrealistically short nor long is therefore needed.

Research findings have also reported that the use of science laboratories is important in the implementation science curricula. A study by Raghubir (1979) demonstrated that students learning science in an entirely investigative manner "acquired a greater understanding of science, greater information retention, and better ability to think scientifically" than those who had been taught by the "lecture-laboratory" approach (p.16). In a similar study in which Saunders and Dickinson (1979) compared academic performance of students learning by "lecture-only" method and those taught by "lecture-laboratory" method, students following the latter method achieved more than their counterparts taking the same courses but taught by the former method.

Thus the laboratory should be a place where "the discovery by a student is both possible and encouraged" so as to facilitate the acquisition of scientific skills and

attitudes (Lunetta and Tamir, 1981, p.636). In the context of principles of learning, this means that "Students learn best by being involved" (Sund and Trowbridge, 1973, p.27). Laboratory based instruction is assumed to be an efficient way of promoting active learning. Maundu (1986) in his study of three types of secondary schools in Kenya indicated that less adequate physical resources (including laboratory equipment and materials) rendered student preparation for national examinations difficult. Resources seemed to play an important role in explaining the wide variations in academic performance among students. However, Maundu argued that more research was required to explicitly detail the way in which facilities affected academic excellence.

Textbook availability as a resource has also been shown to be consistently related to achievement in developing countries. Studies done in such developing countries as Uganda, Thailand, Ghana, India, Chile, Brazil, and Malaysia indicated that access to reading materials is positively related to student achievement (Heyneman et al. 1981). From the study, Heyneman et al. concluded: "in sum, the evidence available suggests that an investment in textbooks will produce learning gains; and that this is more likely to occur as a result of textbook investment than it is as a result of other educational interventions such as teacher training" (p.245).

While many research findings have found that the

availability of resources has a positive impact on learning, Coleman et al. (1966) found no evidence of direct effects of physical resources on learning in schools in the United States of America. As well, Rutter (1979), in a study of secondary schools in England, found no relationship between resources and student success. This might be due to the fact that the two studies were conducted in developed countries where schools universally have more available resources as a basic set.

What can be said generally about resource materials is that adequate facilities, equipment, books and other instructional materials are necessary if curricula have to be implemented effectively. Even highly competent teachers will find it difficult to teach effectively in inadequate facilities or if they are lacking the necessary instructional materials (Cohn and Rossmiller, 1987).

2. In-service training

While research trends show that adequate facilities, equipment, books, and other instructional materials are necessary if a school is to be effective in curriculum implementation, it is also evident that materials and facilities alone will not ensure effective implementation if those who teach in them are not competent or if their decision making is unduly constrained (Cohn and Rossmiller,

1987, p.394). The task of preparing competent teachers should therefore receive attention.

Failure to realize the need for in-service training is a common problem in curriculum implementation. Even when in-service training is provided, there is always the danger that it will not address the problems encountered during the actual implementation. Fullan (1982) contends that most in-service training is not designed to provide the ongoing, interactive, cumulative learning necessary to develop new conceptions, skills, and behaviour. No matter how much staff training occurs, it is when people actually try to implement new approaches that they have the most specific doubts and concerns. It is thus extremely important that people obtain some support at the early stages of attempted implementation. Getting over this critical hump represents a major break through for working toward thorough change (Huberman, 1981).

Since teachers are the curriculum implementers there is need to re-educate them so that they develop the greater understanding and commitment for effective and continued implementation. Louis and Rosenblum (1981) report that the amount of staff training is not necessarily related to the quality of implementation, but it can if it combines pre-implementation training with training during implementation and uses a variety of trainers.

Tamir (1978) stresses the importance of continued

training: "When in-service training is not conceived as a short summer preparation course but rather as a continuous, regular service offered to teachers over the years and utilizing appropriate materials and strategies, it does yield positive outcomes" (p.51). He argues that the short life span of most curriculum projects and their failure to provide continuous support to their teachers may be the reason for unsuccessful implementation.

Implementation whether it is voluntary or imposed, is none other than a process of resocialization. The process of resocialization is interaction. Learning by doing, concrete role models, meeting with resource consultants and implementers, practice of behaviour, the fits and starts of cumulative, ambivalent, gradual self confidence all constitute a process of coming to see change more clearly (Fullan, 1982).

Successful approaches to implementation are effective when they combine concrete teacher-specific training activities, ongoing continuous assistance and support during the process of implementation, and regular meetings with peers and others. Research on implementation has demonstrated beyond a shadow of doubt that this process of sustained interaction and staff development are crucial regardless of what change is concerned with (Louis and Rosenblum, 1981).

In summary, it appears that intensive in-service

training (as distinct from single workshops or pre-service training) is an important strategy for implementation. Apparently, this experience functions to provide teachers with demonstration models and experiences as well as psychological reinforcement conducive to resocialization. However, there are still many unanswered questions about the nature of in-service training concerning the amount of structure and duration, the best type of trainers, and the frequency of the training.

3. Difficulty of content and subject matter

Content may be thought of as the specific facts, concepts, principles or organizations, and thought systems included in the curriculum (Leithwood, 1981, p.32). The introduction of conceptually difficult material can be a serious limitation to implementation. Tamir (1978) notes that in their attempt to update the contents of the science courses and to teach "real" science reflecting the structure of the disciplines, many curriculum projects under-estimated the complexity and difficulty of the subject matter, on one hand, and over-estimated the capabilities of the students to comprehend the scientific skills on the other hand. He adds, "many innovations in science education are unpopular because they do not take into account the learners' learning readiness ... there is usually a premature presentation of certain concepts (p.55).

Related to the area of content in any curriculum is the notion of the "mastery/coverage" dilemma. In all courses there is a body of material, topics listed in an instructor's syllabus or an assumed content of a standard course, to be covered. At the same time, there is an expectation of mastery of that content from the very notion of teaching. Teachers face two conflicting expectations as they conceive of the structure of the subject they teach. They expect to cover given amounts of material and they also expect their students to learn something of what is covered. Teaching decisions aimed at meeting one expectation often tend to hinder meeting the other. Hauwiller (1981) termed the problem, which these expectations pose, the "mastery/coverage" dilemma. "There is always the danger that neither coverage of an ideal array of content nor an appropriate mastery of the elements of that content is achievable to the satisfaction of the teachers (p.55).

Clarity (about goals and means) is another problem in the implementation process. Problems related to clarity have been found in many studies (e.g, Aoki et al., 1977, Chaters and Pellegrin, 1973, Weatherly, 1979). Fullan (1980) contends that policy makers and programme planners tend to write vague and abstract statements of a programme's goals and the means towards these goals. The curriculum guidelines can read well and seem clear but the clarity is often related to the goals and content, not to the "hows" of

teaching strategies and instructions (p.74). Teachers and others therefore find that the change is simply not clear as to what it means in practice.

In sum, it is clear that for proper curriculum implementation, the course content should be at the learner's level of comprehending. The amount of material should also be within limits of the time stipulated for the coverage of the particular syllabus. In addition, the implementers (teachers) should be clear about the goals of the curriculum and should have a good grasp of the subject matter. Finally the schools should have have a reasonable supply of resources for teaching.

4. Teacher-teacher relationships

The theory of change clearly points to the importance of peer relationships in the school. Change involves resocialization. Interaction is the primary basis for social learning. New meanings, new skills depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support and positive feelings about their work (Little, 1981). Many research findings (e.g., Berman and McLaughlin, 1978, p.118-120; Rosenblum and Louis, 1979; Miles et al., 1978) confirm that the quality of working relationships among teachers is strongly related to implementation. Good working relations function as a means

of identifying problems encountered during implementation in order to provide support for addressing such problems.

Collegiality, open communication, trust, support and help, interaction, and morale seem to be vital for working through the process of implementation. Downey et al. (1975) in an Alberta province-wide sample of teachers found that 80% of the teachers rated other teachers as always or often helpful in planning as compared to 28% for consultants and less than 50% for principals.

5. The role of the principal

Among the attributes of effective schools commonly identified in the literature is school site management. Many researchers have concluded that leadership is necessary to initiate and maintain the school improvement process. "Projects having the active support of the principal were most likely to fare well" (Berman and McLaughlin, 1976, p.124). Hall and Loucks (1977) monitored the teaching of science in 80 elementary schools in Colorado and found that the degree of implementation by teachers in a school was a direct function of what the principals did. They reported that in schools with better implementation, the principals were concerned about supporting and helping teachers in their use of the innovation. In the other schools, principals did not get personally involved with the teachers

and their use of the science innovation. Rather these principals delegated responsibility or made major decisions with little follow-up on the results.

Although leadership need not be restricted to the school principal, Cohn and Rossmiller (1987) contend that the essence of the term "school leadership" centers on the principal. While there is general agreement that the principal strongly influences the likelihood of change, other research indicates that most principals do not play instructional leadership roles (e.g. Fullan, 1981, Leithwood and Montgomery, 1981). Principals enhance implementation by supporting teachers both psychologically and by providing resources. Principals are continuously faced with the task of motivating teachers to expend the time and energy necessary for implementation. In some cases, this may involve overcoming initial resistance of staff people (Kritek, 1976). Berman and McLaughlin (1976) report that one of the indicators of active involvement is whether the principal attends workshop training sessions. Through such workshops the principal will be able to understand better their teachers' concerns and thus be able to provide support for implementation.

Michael (1980), and Seifert (1981) emphasize the concept of effective instructional support as being a major factor in implementation. Other findings such as those of Cawelti (1984) stress that "the difference between effective

principals and others seems to lie in their knowledge of quality instruction and this drives their judgement on how to spend their time" (p.3).

Successful principals are able to find resources where others see the procurement of resources as an insurmountable problem (Dwyer, 1984, p.30). Blumberg and Greenfield (1980) studied the personal behaviours of effective principals and noted that they are constantly finding ways to facilitate the school improvement process. Squires et al. (1981) argues that by fostering the teacher's professional growth both principal and teacher are better equipped to focus their skills on a primary concern, improving student achievement. Similarly, Shoemaker and Frazer (1981) indicate that "enlightened principal intervention" within the school is extremely important in promoting effective learning. Such improvement programmes include curriculum improvement and teaching practices, encouraging professional growth among the staff and "rapport nuturance" (Krawjewski, 1984, p.4).

Furthermore, effective principals are not hindered by limited resources provided through the normal channels (Cawelti, 1984, p.3). In fact, the author continues, "it is rare that a principal accomplishes much by way of school improvement if he or she is not a maverick" (p.3). Goldhammer and Becker (1971) found that principals in successful schools were aggressive in securing recognition of the needs of their schools, and they frequently were

critical of the constraints imposed by the central office and of the inadequate resources. The ambiguities that surrounded them and their work were of less significance than the goals they felt were important to achieve (p.3).

Research findings have also reported that effective principals assume the position of "chief" and through a process of modeling, set the tone of the school and signal to all within the environment accepted norms and values. Sergiovanni (1984) and Squires et al. (1971), note that leadership activities including such things as visiting the classrooms, touring the school, spending time with students, presiding over ceremonies and rituals give a clear image of involvement. They therefore, transmit through a continuous stream of action, clarity, and commitment a definite sense of direction for the school community (Deal and Kennedy, 1983). Sergiovanni (1984), reports that "students and teachers alike want to know what is of value to the school and its leadership; desire a sense of direction; and enjoy this sense of direction with others" (p.7).

Fullan (1982) provides a summary of what is known about the role and impact of the principal on change. First, many principals operate mainly as ad hoc managers and have hardly any time for the supervision of instruction. These principals are not effective in bringing about changes in their schools. Second, those principals who do become involved in change do so as direct instructional leaders or

facilitative instructional leaders by providing conditions that are conducive to the change process. Both styles of leadership can be effective. Third, the principal cannot become an expert in all subject areas, and has great demands on his or her time, especially in larger schools.

Most of the research and literature reviewed in this chapter stems from developed countries, notably North America. It is of significance to establish whether the findings apply to a developing nation such as Kenya. Moreover, some of the findings seem to be contradictory to commonly held belief. A case in point is the Coleman report (1966) which found no evidence of direct effects of physical resources on learning. In developing countries, Kenya specifically, it is widely believed that the availability of school resources greatly influences learning. Through its exploratory and descriptive nature, the present study seeks therefore, to examine implementation within the context of a developing country.

Case studies on the implementation of the 8-4-4 system of education in Kenya have not been undertaken before. The findings of the present study would therefore, provide empirical data regarding implementation. While findings from the study could not necessarily be generalized to other school settings, they would enable educators to develop possible solutions aimed at overcoming the barriers to implementation. In addition, the findings could bear direct

implications on educational policy making and planning in Kenya.

2.4 Research Questions.

In order to carry out the study and to limit its scope during data collection, two research questions were formulated:

1. How is the subject being implemented?
    a) Do teachers use recommended teaching techniques appropriately both in class and in the laboratory?
    b) Do they use recommended field work to make students understand certain topics?
2. What are the teachers' and school heads' concerns regarding the implementation of the biological science curriculum?

CHAPTER THREE.

3.0 METHODOLOGY.

3.1 INTRODUCTION.

The purpose of the present study was to explore how the implementation of the 8-4-4 biological science curriculum was being undertaken at the secondary school level in Kenya. This chapter discusses and highlights the procedures, sources of data collection, and data collection modus operandi. Sampling and instruments used are also identified. The chapter ends with a portrait of the two schools included in the study and the limitations of the study.

The researcher obtained permission from the office of the president of the Republic of Kenya in Kabarnet in order to begin collecting data (Appendix C).

While it was recognized that a district-wide survey would be preferable to a case study, financial and time constraints could not permit such an undertaking. The study focused therefore on two schools in the researcher's home district of Baringo in the Rift valley province of Kenya.

3.2 SAMPLE.

In Baringo district there is a total of 34 secondary schools. Seven of these schools are fully maintained by the government, 4 are Harambee and the remaining 23 are government-assisted. Most of the government-assisted schools have one government stream and one Harambee stream within the same school under one administrator.

The study was carried out in two government-assisted secondary schools; one with only a government stream and the other with a Harambee and a government stream. Most of the schools in these two categories are relatively young and poorly established in terms of physical facilities and human resources. The researcher believed that studying such schools would be preferable to studying government-maintained schools in terms of highlighting the problems encountered during the implementation of the secondary school biological science curriculum. In addition, government-assisted secondary schools form a large proportion of the secondary schools in the district and therefore are more representative of problems faced by the majority.

Government-maintained schools are well established with adequate physical facilities. Their laboratories are well equipped and are manned by qualified laboratory assistants and professionally trained competent science teachers. In

light of this, the researcher was of the opinion that the findings emanating from the study of such schools would depict a false picture of the implementation process because there are fewer obstacles when compared to the usually poor and average Harambee and government-assisted schools respectively.

Baringo district has generally two geographical zones. The upper part of the district is an agriculturally high potential area where the bulk of the food for the district is produced. This is in contrast to the lower semi-arid region which has a poor agricultural potential. The main source of income in this region is derived from raising domestic animals notably goats, sheep and cows. The researcher believed that this geographical difference might be a contributing factor in case there was any differential implementation of the 8-4-4 secondary school biological science curriculum between the schools of the two geographical zones. Two schools were therefore chosen; one from each of the geographical zones mentioned above. The school in the semi-arid part of the district was government-assisted and the other had one government stream and one Harambee stream.

The question of anonymity was considered to ensure reliability and validity of the data. The school situated in the semi-arid region of the district and that in the agriculturally high potential part of the district were

designated school A and school B respectively. The anonymity of the participants was also respected.

A preliminary visit was made to the schools to allow the researcher to examine each, and to gauge their receptiveness to the study as well as to establish rapport with the heads and biology teachers. At the initial contact with the headmasters the research project and its purpose were explained. The researcher met and talked informally with the biology teachers. A time frame for data collection which was convenient for them was agreed upon.

In collecting the data, caution was taken by the researcher throughout the field work to:

1) emphasize the researcher's role of learner with the purpose of being educated and enlightened by the participants.

2) Establish an equal status between the researcher and participants- this was made easier by the fact that the researcher was in his home district as well as the fact that participants had been exposed to other studies by other researchers. Hence they seemed less threatened at volunteering information to an outsider.

3) Refrain from giving any advice or moral judgement on what was observed.

4) Refrain from interviewing either the teachers or the heads specifically for dissenting views beyond the scope of the study.

3.3 INSTRUMENTS.

Due to the exploratory nature of the case study, a single method of gathering data was considered limiting. Four methods: observation, interviews, questionnaires, and recording were chosen because they tapped different types of data critical to the study. Ministry of Education documents, specifically the reports of the three Education Commissions, were also examined. All the methods were used so that data collected by one method could supplement those gathered through the other methods. This section discusses the four methods that were used to gather data.

3.3.1 Observation.

One of the more obvious ways of gathering data was by observing the culture or environment under study. Observation within the physical and social environment allowed for the tapping of first-hand information from the participants who offered current information of the environment, and more specifically, on the research questions and aspects under study.

Observational procedures relied on the methodological principles of Spindler (1982) who insisted that "because one is attempting to understand a system in its own terms, according to its own critera of meaningfulness, one cannot

predict in advance which aspect of the system will have a significance" (p. 459). Five aspects identified in the literature were focal points of observation and any information on them was documented. The five aspects were: resource materials, in-service training, difficulty of content and clarity of goals, teacher-teacher relationships, and the role of the principal.

The researcher was given access to each of the schools for some weeks. Observational settings included: classrooms, laboratories, headmasters' offices, dormitories, dining hall, and play grounds. In both the laboratories and classrooms, a seat was made available at the back row to reduce student distraction. Written notes were made.

3.3.2 Questionnaires.

Two questionnaires-- Secondary School Administrator's Questionnaire (SSAQ) and Secondary School Biology Teacher Questionnaire (SSTQ) were designed for the biology teachers and head teachers (Appendices D and E) respectively. Before introducing the questionnaires to the respondents, the researcher explained that there were no right or wrong answers, and that all the questions should be answered honestly. They were also told that their responses would be treated confidentially. Three questionnaires were issued to school A and another three of the same type were also

issued to school B. The biology teachers gathered in their respective staff rooms in order to complete the questionnaires. The headmasters completed theirs in their respective offices. All the questionnaires were collected on completion.

3.3.3 Interviews.

The researcher interviewed the headmasters and biology teachers in the two institutions. Interviews with the headmasters took place in the headmasters' offices while those with the biology teachers took place in the preparation room of the laboratory and at times in the staff room.

All interviews were conducted informally through discussions rather than through a set of structured question and answer forms. This informal strategy was believed to be better since it would create a more relaxed less threatening atmosphere and hopefully encourage more honest and complete responses from the interviewees. The purpose of these interviews was to solicit information that would supplement both the questionnaires, observations, and classroom recordings.

3.3.4 Class Recordings.

A number of audio recordings of laboratory sessions and classroom teaching were made during the study. The recordings were used for illustrative purposes to indicate how the secondary school 8-4-4 biological science was being implemented. In total, 22 lessons were recorded, eleven from each of the two schools.

3.4 PORTRAIT OF THE TWO SCHOOLS.

3.4.1 School A.

School A, a boarding co-educational institution was started in 1978 through self-help efforts of the local community in response to the shortage of Form I places in government secondary schools. At its inception, it admitted 29 students, 19 boys and 10 girls. The classroom which was used by those students then was in an extra unoccupied building in the local primary school. The primary school head teacher handled the administrative duties of the new secondary school. Most of the 29 students were recruited from the local primary school.

In 1979, the community acquired a 30-acre plot (the school's current site), three kilometers from the primary school. The school became government-assisted in 1980

through the admission of Form I students that year. By 1983, the last Harambee stream was phased out. All the classes (Form I to Form IV) were government-assisted at the time of the study with a student population of 183; 113 boys, and 70 girls. All the students resided in the school.

Uniform was compulsory in school A. For boys, it was a pair of grey shorts, white short-sleeved shirts, a grey pullover, black leather shoes and grey socks. For the girls, the uniform was a grey skirt, short-sleeved white blouses, and a grey pullover. Black leather shoes and white socks completed the uniform.

The school was situated about 40 km east of Kabarnet the district headquarters in a low altitude, semi-arid region of the district. At the time of the research (January-March), the temperatures were quite high and escalated up to 40 degrees celsius at mid-day. But despite being situated in this region of the district, the school had a zero-grazing unit that raised three dairy cows. In addition, it had a poultry unit that kept 50 layers. These two projects generated extra revenue for the school.

A 500 meter murram road branched from the Nakuru-Marigat road to connect to the school. It led directly to the headmaster's office. The sign post displaying the school's name was rather inconspicuous. There were some beautifully constructed teachers' houses to the right, a few meters from the main gate. They were fenced off by barbed

wire. To the outside of the barbed wire, there was a smartly trimmed green live fence of Eurphobia, a hardy plant common in dry places. There were a total of 11 teachers, 7 male, and 4 female. All of them resided in the school compound.

The head's office was isolated from the other buildings. It was a small semi-permanent timber building which also housed the secretary's office. The office was so small that it could hardly accommodate two visitors at a go. It was in bad shape having been damaged by termites which are quite abundant in this region of the district. The headmaster was in his early thirties and had two years in his present position in the institution. Prior to this, he had been deputy headmaster in the same school for 3 years. He had 6 years of teaching experience, teaching Kiswahili and Geography.

A few meters from the head office lay the tuition blocks, staff room and laboratories. The staff room was small and full of chairs, making it difficult to move about in it. The school had two laboratories; one general laboratory for Biology, Physics, Agriculture, and Chemistry and one for Home science. The general laboratory was better constructed and had more equipment than the one in school B. Boys' dormitories were separated from the girls' dormitories by a big dining hall. Apart from the headmaster's office, all the buildings in the school were permanent structures (stone blocks and corrugated iron sheets). The school had

duplicating and telephone facilities but it had no means of transport of its own.

The compound was fenced and spacious. To the west of the school was the play grounds which had soccer, netball, and volleyball courts. These courts were bare ground without any trace of grass. Blowing dust was a common site in the school and was a major nuisance to the students and teachers especially during games time. The only visible vegetation in the school and its environs was comprised of scattered xerophytic plants notably of eurphobia, cactus, and acacia families. To the north of the school was a river which fed an irrigation scheme situated to the east of the school. To the south and extending south-west of the school, there were commercial buildings serving as shopping and residential premises. In addition, there were government offices serving various ministries. The area was a Divisional Headquarters (Eastern Division) of the district.

A bell marked change-over of activities in the school. The scheduling of lessons was different from that of school B. Lessons began at 7.30 a.m. and continued up to 12.30 p.m. for the morning session. Lunch was served at 12.45 p.m. and students went on a long recess until 3.00 p.m. when the afternoon session began. Classes ended at 4.20 p.m. when students went for games and other extra curricular activities. This scheduling was attributed to the hot climate of the locality. Classes had to begin early enough

in order to avoid the intense mid-day heat. At this time, the morning session would be over. Students began afternoon classes at 3.00 p.m. when the heat intensity had reduced considerably.

3.4.2 School B

School B, also a co-educational institution like school A, was started in 1976 through "harambee" efforts of the local community. At that time, it admitted 35 students, 25 boys and 10 girls. As in school A, the majority of those students were recruited from the local primary school. In 1978, the number of students seeking admission into the school was too great thus prompting the local community to start a second Harambee stream in the school making it a double stream, that is, admitting 80 students in each class from Form I to Form IV.

In 1980, one stream was taken over by the government and the school thus became government-assisted as well as retaining one Harambee stream. At the time of the study, the school had a student population of 365; 240 boys, and 125 girls. All the students lived in the school. There were in all 22 teachers, 17 male and 5 female. Of the 22 teachers, only 8 could be accommodated in the school. The rest operated from the nearby shopping center about 700 meters from the school where they rented residential premises. The

headmaster who owned a van operated from his home 7 kilometers away.

Like school A, uniform was compulsory in school B. For girls, it was a blue skirt, white short-sleeved blouse, a blue pullover, black leather shoes and white socks. For the boys, the uniform consisted of blue shorts, white short-sleeved shirts, and a blue pullover. Black leather shoes and grey socks completed the set.

The school was situated in a 20 acre agriculturally high potential area of Baringo district at an altitude of about 7,000 ft above sea level. It was about 16 km north of Kabarnet the district headquarters and was situated along Kabarnet-Kabartonjo road. The school was surrounded by a thick forest to the north and a thickly populated human settlement to the west. To the south lay a small shopping centre and to the east, immediately after the main road was yet another thick forest. Being surrounded by a forest and being situated at a high altitude, the temperature around school B was much lower than that around school A.

A twenty meter murram road branched from the Kabarnet-Kabartonjo road to connect to the school. The gate into the school was constructed from timber which was painted with eye-attracting colors. A sign post displaying the name of the school, conspicuously stood near the gate in a manner that one would read it from a distance. The road led directly to the secretary's office which was attached to the

head's office and served as a reception for visitors as well as a waiting room. The secretary shared the small congested room with the accounts clerk.

There were two long blocks in the school running parallel to one another. The front block was a permanent building, i.e constructed of stone blocks and roofed with corrugated iron sheets. It housed four classrooms, the headmaster's office, and the secretary's/accounts clerk's office. Just behind and running parallel to that building was a semi permanent building constructed of timber and roofed with iron sheets. The building housed another four classrooms, a staff room, and the deputy headmaster's office.

The staff room was obviously congested with small desks and chairs arranged along the wall where teachers corrected student assignments, made lesson notes or at times simply talked about issues concerning the school. There was a large table in the middle of the room from where the 10 o'clock teachers' tea was served. The headmaster also came into the staff room at such times for tea and made important announcements to teachers, for example those pertaining to various date lines for certain work to be completed, games competitions with other secondary schools in addition to addressing certain issues raised by the teachers.

Every available space in the compound seemed utilized. There was a dining hall to the west of the second block and

a general laboratory to the north. The laboratory had a few movable chairs and tables. There were no sinks, side benches nor a water supply in the laboratory. It was generally ill-equipped with a few pieces of equipment and a few chemicals and it served as a classroom as well since it was used for theory lessons. The school had duplicating and telephone facilities and electricity. There was no means of transport but the headmaster had a private van.

The dormitories were close to the dining hall. Both the boys' and girls' dormitories were fenced off with tight barbed wire except for one gate each. They were separated from each other by an open space about 10 meters. A watchman kept active vigil particularly in the evenings and at night.

To the south-west of the administration block lay the play grounds. Soccer, volleyball, and netball were played in different courts in the seemingly evergreen ground. The school had 5 dairy cattle that grazed in the field also. The milk productivity of the cows was quite high and the extra milk after the school's use was sold to the teachers and members of the local community. In this way additional revenue was generated for the school.

The headmaster was in his early forties with 4 years of administrative experience. Apart from his administrative duties, he taught a total of 6 lessons per week in History and Social Ethics and Education. His office was congested but orderly. Visitors freely entered it with or without

appointments. As in school A, a bell marked change-over of activities in the school. Classes started at 8.15 a.m. and ended at 4.00 p.m. with one hour and half lunch break each week day. At 4.20 p.m. students went for games and other co-curricular activities.

3.5 LIMITATIONS OF THE STUDY.

Study limitations arose mainly from the methodology. The case study approach was the most advantageous strategy for the research project. However, that approach has one obvious limitation, namely that results from the study cannot be generalized. The results should, however, help in further understanding of curriculum implementation in Kenya.

CHAPTER FOUR.

4.0 Description of Data.

4.1 Introduction.

The study explored the implementation of the 8-4-4 biological science curriculum at the secondary school level in Kenya. Two schools were chosen as the units of analysis for the case study and a variety of data were collected in an effort to understand the implementation of the curriculum. Audio recordings, interviews, observations, and questionnaires supplied the data.

This section describes the data collected and highlights study findings. Table 4.1 presents general information about the two schools of the study. In the presentation of the findings, the following variables are the focus of the discussion: 1.Resources, 2.Difficulty of content and clarity of goals, 3.In-service training, 4.Teacher-teacher relationships, and 5.The role of the principal. The five factors form a system of variables which interact in the implementation process. It is only for convenience that they are discussed separately.

TABLE 4.1
GENERAL INFORMATION ABOUT THE TWO SCHOOLS.

	SCHOOL A	SCHOOL B
Students	183	365
Teachers	11	22
Male teachers	7	17
Female teachers	4	5
Deputy head	NONE	1
Laboratory assistant	1	NONE
Number of classes	4	8
Average class size	46	48
No. of Biology teachers	2	2
Biology teachers lessons/week	14	21
Other classes taught by biology teachers	3	6
Libraries	1	NONE
Acreage of compound	30	20
Students:Biology textbook	6:1	10:1
Play grounds	1	1
Laboratories	2	1
Staff rooms	1	1
Dining halls	1	1
Duplicating machines	1	1
Secretary	1	1

As illustrated in Table 4.1, school B had double the number of students that were present in school A. Unlike school B, school A had a laboratory assistant but it had no deputy head teacher.

4.2 Resources.

The research findings revealed four crucial areas pertaining to resource materials: 1. Science laboratory; 2. Laboratory assistant; 3. Number of biology teachers; and 4. Textbooks.

4.2.1. Science Laboratory.

A Chinese proverb lends support to the value of the science laboratory in the implementation of science curricula as follows:

"I hear and I forget"
"I see and I remember"
I do and I understand"
(In Wardsworth, 1978, p. 161).

Contemporary science educators likewise consider the laboratory to be an important component of science instruction (Shilman, and Tamir, 1973, Hurd 1961, Tamir, 1977, Ausubel, 1968, Schwab, 1962, Yager, Egen and Snider, 1969, Kyle et al. 1979, Sund and Trowbridge, 1973).

An analysis of the general characteristics of the new 8-4-4 secondary school biological science curriculum as contained in the Kenya national examinations council (KNEC) syllabus and guidelines suggests that laboratory science

activities are not only vital but absolutely necessary for improved achievement(KNEC, 1991-92).

In particular, the practical examination (Paper 2) at the end of the four-year secondary cycle requires the candidates to have mastered a certain body of knowledge and acquired a number of scientific processes and manipulative skills. Introduction to such skills and repeated guided practice is necessary before the students can function efficiently on their own (Beyer, 1985). Presumably, this is only possible if a school has a laboratory and the necessary equipment and/or apparatus. The two schools of the study had general laboratories. The researcher considered certain laboratory items as being essential in the teaching of biological science. Table 4.2 illustrates the availability of these items in both school A and school B.

TABLE 4.2
AVAILABILITY OF LABORATORY ITEMS IN SCHOOL A AND SCHOOL B

Laboratory item	School A	School B
Dissection kits	11	5
Microscopes	4	2
Microscope slides	150	100
Permanent slides	12	5
Tissue/cell stains	3 Types	None
Live specimens	10 Rats	None
preserved specimens	16	10
Water trays	10	None
Quatrats	14	None
Iodine	2 Litres	2 litres
Millons reagent	1 Litre	1 Litre
Benedict's solution	1 Litre	1 Litre
Bunsen burners	20	23
Chloroform	0.5 Litres	None
Hand lenses	20	30
Potometers	2	None
Enzymes	2	None
DCPIP	0.5 Litre	None
Charts	12	6
Models	3	None

As shown in Table 4.2, school B lacked many of the resources observed in school A. School A's biology teachers reported many items required for the teaching of biology as being generally available throughout the year. It should be noted, however, that the availability of an item does not necessarily imply adequacy. For instance, the school had 4 microscopes for its 183 students thus the number of microscopes was insufficient.

Microscope slides, tissue/cell stains, live specimens for dissection (rats), preserved specimens, potometers, and enzymes were also reported as being available but inadequate. Lack of adequate materials seemed to hamper greatly the teaching of the subject. Of particular concern to the teachers was the inadequacy of preserved specimens particularly marine specimens. This could be attributed to the great distance from school A to the Kenyan coast (over 600 Km) where marine specimens can be obtained. The only available marine specimens in school A were a star fish and a clam shell.

School A seemed to have sufficient charts for teaching biological science. The charts were beautifully displayed on the walls of the laboratory. In evidence were charts representing the various mammalian systems: respiratory, circulatory, nervous, excretory, reproductive and digestive. Charts showing the two types of cell division; mitosis and meiosis were also available. Others included charts on the skeleton, bones, joints, and muscles, sense organs, the stem, the root, and the Krebs's Citric acid cycle. Most of those charts had been recently purchased. The teachers seemed keen in making use of them when dealing with the relevant topics in the various classes.

Permanent slides were also available: dicot stem, zea stem, amoeba, paramecium, pollen grains, bacteria, transverse sections of leaf, root, intestine, spinal cord,

artery/vein, and skin. The school was, however, short of models. It had three models only: ear, heart, and eye. Important models including those of the kidney, brain, and human skeleton were missing.

The biology teachers in school B reported many of the essential laboratory items as being either inadequate or not available throughout the year (Table 4.2). Bunsen burners were the only items reported as being adequate. The school had 2 microscopes for its 365 students. This was grossly inadequate.

Live specimens, water trays for dissection, quatrats and potometers were not available in school B. There was not a single preserved marine specimen. The only observed preserved specimens included; chameleon, frogs, snake, tadpole, slug, ants, pieces of kidney, vertebrae (cervical, thoracic, abdominal, and anal), teeth (incisors, canines, premolars and molars) and the skull of a cow. The school had very few charts for teaching biological science. These few had been drawn by the teachers on manila paper. They represented some mammalian systems: digestive, respiratory, reproductive and excretory. Two charts depicting meiotic/mitotic cell division and another showing the human skeleton/bones/joints had been purchased recently and had not been unwrapped yet. Unlike school A, school B had no models for teaching. However, a few permanent slides were available: amoeba, paramecium and transverse sections of the

root, stem and leaf.

The lack of teaching resources appeared to be quite frustrating to the teachers in school B. One biology teacher seemed to paint such a picture: "...If you follow the set down objectives as far as the syllabus is concerned, you find that it is too demanding, too straining. You see so many demonstrations which you need to do, but when you look around you can't find what to demonstrate with". This teacher was reacting to a lesson he had just completed in class. The lesson was on "Chemicals of life". The teacher was required to test for vitamin C (Ascorbic Acid) in fruits using Dichlorophenol Indole Phenol (DCPIP) but he could not do it since the chemical (DCPIP) was not available. He concluded "there are many other instances when we are rendered helpless by the absence of either apparatus, specimens or chemicals".

4.2.2. Laboratory Assistant.

One variable that was not emphasized in the literature on implementation but which appeared to exert great influence on implementation as revealed in this particular situation was the presence or absence of a laboratory assistant. As the name implies, a laboratory assistant helps the science teachers to accomplish their laboratory lessons by assembling the necessary specimens or

materials/apparatus ready for the laboratory classes.

A secondary school teacher has many responsibilities in addition to his or her major assignment--teaching. A laboratory assistant is in light of this, of some importance because he or she relieves the biology teachers of some of the work thus affording them more time to attend to other duties. The teachers in school A took an average of 3 hours to prepare for laboratory lessons while those in school B took 2 hours. School A had a laboratory assistant who had been employed for 2 years. The teachers reported that she was of tremendous help in the preparation for laboratory lessons. She assembled apparatus, collected flowers, vegetative materials, seeds, fruits, and live specimens such as frogs for dissection, and she was handy during the actual laboratory activities thus contributing positively to the implementation process.

School B had no laboratory assistant. This meant that the biology teachers not only prepared laboratory lessons but also assembled the apparatus/materials and or specimens single-handedly for the laboratory classes. Because of this, they spent less time in the preparation of laboratory lessons than the teachers in school A. According to one of the teachers; "... the assembling of the necessary materials, apparatus or specimens for a laboratory class was the most time-consuming exercise and could take up to 3-4 hours". This hampered the implementation process since it

led to delays in starting classes because the required materials were usually not ready on time. In addition, there was hardly any time to test the experiments prior to the laboratory lessons to ascertain whether they would work or not. This led to embarrassing situations at times when the anticipated experimental results did not surface.

4.2.3. Number of biology teachers.

The study also found that the number of biology teachers played an important role in the implementation process. Each of the two schools had 2 biology teachers. While the biology teachers in school A did not complain about the work load, number of preparations and number of classes taught per day, those in school B complained of a heavy work load. The reason for this can be understood. School B had twice as many students (365) as school A (183) for the same number (2) of biology teachers. The biology teachers in school A taught 14 biology lessons per week while those of school B taught 21. In addition, they taught other subjects. Those in school A taught another 3 lessons and those in school B taught an extra 6 lessons.

The situation was confounded by large class sizes. The two schools had an average of 45-50 students per class. Substantial amounts of time had to be devoted to correcting assignments and marking interim examinations. The situation

was aggravated further by the wide range of student ability as a teacher in school B explained:

> "All my classes are large with a wide range of student ability from nearly retarded ones to bright ones. It is only the brighter students who can survive... It is a disaster for the dull students; they just drag. There is no time to give them the much needed individual tutoring"

It should be noted that even if reduced class size had a positive impact on implementation, this would be hard to achieve in Kenya in the near future because of her high population growth (3.8%). Unless the population growth reduces substantially, over-enrolment is expected to persist.

Research findings have often proposed class size as an important factor which influences many of the variables in the educational process. Cahen et al. (1983) states that on the average, student productivity increases as class size is reduced and the advantages rise sharply for a class with 15 students or fewer. This might be due to the fact that the smaller size facilitates classroom management; teachers feel more in control and more individualized teaching occurs. Presumably, with a smaller class, the task of preparing lessons and marking assignments becomes less difficult.

4.2.4 Textbook Availability.

Most science educators (e.g Ausubel, 1968, Heyneman et al., 1981, and Maundu, 1986) believe that supplementary reading can improve the quality of science instruction. Such reading helps to supply the back-up knowledge necessary for the consolidation of theory with practice (Hurd, 1961). It is therefore of paramount importance that secondary schools have an adequate supply of relevant textbooks for proper instruction.

In school A, 6 students shared a biology textbook. The school had no library. Instead, it had a small room in which fewer than two hundred books were kept for use by the 183 students. There was a total of 45 biological science books which were used mainly as reference. Students from the senior classes, that is Form III and Form IV, were allowed to borrow only one biological science book for a two-day duration. The duration appeared too short for a meaningful use of the books. The teachers were of the opinion that public library services should be made available to their students.

School A had a policy that students entering Form I must buy all the important textbooks. Subsequently, as they progressed to Form II through Form IV they were required to buy additional textbooks. This was in line with the government's cost-sharing strategy which arose due to the

great demand for the supply of educational facilities and equipment and hence an increased expenditure under the 8-4-4 system of education. Accordingly, "... Parents will be required to meet the cost of textbooks and supplementary readers, stationery and consumable items for practical subjects" (Republic of Kenya, 1988, p.51).

Although the policy existed in school A, the headmaster reported that it was rather ineffective. One reason was that textbooks were exorbitantly expensive and beyond the means of many families. A single book costs about four days' earnings of a poor family, most of the students came from families with low socioeconomic backgrounds. In addition, many parents still live in the past when schools were expected to provide their students with all the necessary textbooks. Another factor that might have contributed to the reluctance of parents to buy textbooks for their children is that many parents themselves could not read or write and thus did not attach much importance to providing books for their children.

Apart from the lack of textbooks for students in the two schools, the research established one other crucial component about the textbook issue, namely the quality of the textbooks. Teachers reported that the books recommended were of questionable standards. They further complained that the ministry of education had restricted them to Kenya Institute of Education (KIE)-authored books which were not

necessarily the best on the market. The biology teachers in the two schools of the study described the KIE books as being "shoddy, sketchy, too wordy and generally half-baked".

In school B, an average of 10 students shared one biology textbook. The school had no library but the students had access to a nearby Kenya national library service which came to the school at fortnightly intervals. The biology teachers were, however, skeptical about the usefulness of the library service lamenting that the few available biology texts were outdated and therefore of limited use to them and their students.

Like the teachers in school A, those in school B expressed concern about the few books available to students and also the quality of the recommended books. For proper implementation, suggested one teacher; "the number of textbooks shared by learners should be increased. This would encourage individual study, effective administration of assignments and further reading".

The issue of textbooks seemed to be a major source of discontent amongst the biology teachers and head teachers with regard to the implementation of biological science curriculum. They openly expressed their dissatisfaction about textbooks. For example, the head teacher of school B had a bitter pill for the KIE panels that recommended the books; "although members of these panels are practicing teachers and presumably in a better position, the books have

one flaw--different teachers are asked to write different chapters or topics, often resulting in uneven flows of ideas, and non-uniformity of language, and levels of complexity due to differences in style. Hence the resultant books are not necessarily the best"

4.4 Syllabus Content.

Three aspects of content seemed to be important with regard to implementation. The first was the difficulty and the students' ability to understand the material that was presented in the prescribed biological science curriculum. The second was the amount of material that had to be covered within the four years of secondary education. The third was the clarity of the goals and objectives of the syllabus.

4.4.1 Difficulty of Content.

> "The proportion of time spent on-task is higher when students are attempting to learn something which is at an appropriate level of difficulty" (Anderson, 1981, p. 290).

The four biology teachers in the two schools expressed concern about the difficulty of some of the topics particularly at the lower secondary level (Forms I and II). One topic that stood out conspicuously as being difficult at the level it was being taught was "Classification". This was

the first topic to be covered by in-coming Form I students. The teachers were of the opinion that the topic was too difficult because the Form I students were not mentally mature. In addition, the students had no background knowledge for the predominantly Latin words common in the topic. At the primary school level, the topic is just introduced: "Living things are divided into two kingdoms: Plant and Animal. Plants are divided into flowering and non-flowering. Animals are divided into Vertebrates (with backbone) and Invertebrates (without backbones)". When the students enter secondary school, they are expected to learn about the various plant and animal phyla, sub-phyla, classes, orders and genera.

The concept of the "binomial nomenclature" (use of two Latin names) to represent an organism's scientific name, e.g *Phaseolus Vulgaris* for bean, *Felis Leo* for lion, *Homo Sapiens* for man, *Asterias Vulgaris* for star fish was particularly confusing to the students. But they had to cram the Latin names for the sake of passing the national examination. One teacher in school A had this to say about the topic: "The concept of classification appears so abstract... The scientific names are derived from Latin words which are absolutely meaningless to the students". He continued; "what do you expect a Form I to make of terms like, *Mastigophora, Bryophyta, Echinodermata, Rhodophyta, Lamellibranchiata, asteroidea, Coelentrata, Sphenopsida,*

Rhizopoda and so on".

More observations and recordings of class and laboratory sessions on the topic "classification" confirmed that the topic was indeed beyond the students' ability of understanding. The teachers themselves seemed to have a problem in pronouncing some of the Latin words and occasionally called an organism by the wrong scientific name. At a later stage when the teachers were dealing with the notion of the "Dichotomous Key" the students appeared even more confused and completely lost.

Apart from the unit on "Classification" the teachers reported the one on "Respiration" as being too difficult for the Form II students. The difficulty appeared to arise from the "Krebs's Citric Acid Cycle" where the students were supposed to understand what went on in the "Mitochondrion" during aerobic respiration. The steps (Pathways) by which one intermediate chemical compound becomes converted to another was simply too confusing for the form II students who frequently ended up interchanging the sequencing of the various intermediate compounds of the Krebs's Cycle.

An equally difficult topic for the Form II students as reported by the biology teachers in the two schools of the study was "Photosynthesis". Specifically, the concept of "Cyclic and Non cyclic Photophosphorylation" was evidently too difficult for the students who could neither answer nor ask questions about it, an indication that they did not

understand the concept.

4.4.2 Amount of material to be covered.

The Biological science syllabus appeared to be too broad for a satisfactory coverage in the four-year period of secondary school. All four biology teachers in the study concurred with this view complaining that both coverage and mastery of content were hard to achieve. Some of the statements made by the teachers lend support to these two beliefs:

Teacher 1: "The syllabus is too long and the time stipulated for topic lesson numbers is quite inadequate. One can only cover the syllabus if he or she resorts to more theoretical lessons"

Teacher 2: "As concerns the syllabus of biology, it is too wide to be covered within the specified period"

Teacher 3: "The duration available and the syllabus content for the whole course makes the teaching somewhat ineffective. The duration is short and so we are forced to resort to lecture method and occasional demonstration in order to cover the syllabus"

Teacher 4: "Syllabus for biology too wide should be tailored to fit the time allocation otherwise the coverage will continue being shallow".

The teachers appeared geared toward the "completion" of the syllabus at the end of the four years of secondary education. The idea of mastery appeared to be a secondary issue. The teachers seemed to just press on with the topics perhaps hoping that later review by students would somehow provide them with opportunities to more adequately understand the ideas.

The teachers' goal to "complete" the syllabus might explain partly why they resorted to less student interaction modes of teaching. Table 4.3 summarizes the relative time (%) taken by the teaching methods used by the teachers in both school A and school B during day-to-day instruction.

Class recordings and observations were conducted on the following topics: CLASSIFICATION, CHEMICALS OF LIFE, RESPIRATION, EXCRETION , and PHOTOSYNTHESIS. These topics were being taught at the time of the study. The vast majority of lessons observed in both school A and B were characterized by teachers lecturing and students transcribing information into their exercise books. Eleven lessons were observed and recorded in each of the schools. The 22 lessons took a total of 880 minutes.

TABLE 4.3

PERCENTAGE OF TIME TAKEN BY THE METHODS USED BY THE TEACHERS DURING CLASSROOM INSTRUCTION.

METHOD	SCHOOL A (%)	SCHOOL B (%)
Lecture to whole class	61.3	68.1
Lecture accompanied by audio-visual aids	3.4	3.4
Demonstration of laboratory activities	18.1	15.9
Small groups work on laboratory activities	14.7	10.2
Field trips	0	0
Small groups for project work	0	0
Small groups for assignments	2.5	2.5

Approximately 61.3% of the time in school A was used for lecturing while in school B, lecturing took 68.1% of the time. The teachers said that their main objective was to cover the examination syllabus. But there was insufficient time available for that purpose, so they primarily lectured because that was the most efficient way to transmit the necessary information. One teacher in school B best summarized this: "Well, you know why we teach that way, lecturing all the time, it is pressure from the national examination... The inability to cover the syllabus could

result in our (teachers) being blamed for student failure". Lecture accompanied by audio-visual aids took about 3.4% of the time in both schools.

About 18.1% and 15.9% of the time was used for demonstration of laboratory activities in school A and school B respectively. Dividing the class into small groups who work together on laboratory activities took 14.7% of the time in school A and 10.2% of the time in school B. Dividing the students into small groups for assignments occurred rarely (2.5%) in the two schools. Field trips or project work was not observed in the two schools. The reason for this is that the topics observed during the study did not lend themselves to the use of these two methods. The teachers reported, however, that they use projects and field trips when dealing with an appropriate topic such as "Ecology".

The broadness of the biological science curriculum could be attributed partly to the manner in which it was organized. The teachers reported that there was an overlap of some topics in the syllabus. For example, on the topic "Micro-organisms, Viruses and their Economic Importance" some of the material that had been covered in the topic "Human Health" was repeated. The same could be said of the topics "Excretion" and "Homeostasis" which dealt with almost similar content.

In addition to the repetitions within Biological

Science itself, there appeared to be some repetition in other subjects of what had been covered in biological science and vice versa. In Geography for instance, under the topic "Energy" the sub-topic "Renewable and nonrenewable resources" appeared. Exactly the same sub-topic appeared again in Biological Science under the topic "Ecology". An even closer repetition, perhaps a near duplication of some topics occurred in Biological Science and Agriculture. Table 4.4 below shows the overlap that exists between these two subjects; a factor that might account partly for the broad nature of the syllabus and the failure to cover it.

TABLE 4.4

OVERLAP BETWEEN BIOLOGICAL SCIENCE AND AGRICULTURE

BIOLOGICAL SCIENCE	AGRICULTURE
ASEXUAL REPRODUCTION .Natural and artificial vegetative reproduction .Use of vegetative propagation in Agriculture e.g tubers, bulbs, stems cuttings, and use of leaves in horticulture	**CROP PRODUCTION** .vegetative materials .advantages and disadvantages of using seeds or vegetative material
ECOLOGY	**SOIL FERTILITY**
.Biogeochemical cycles: Nitrogen, Carbon, water sulphur and phosphorous	.Carbon and Nitrogen cycles- description and importance to crops
WATER	**WATER SUPPLY**
.Sources of water (bore holes, rivers, lakes, springs and rain) .Water purification and supply at individual and community level	.Sources of water in the farm .Collection, storage, pumping,and treatment of water for farm use
NUTRITION IN PLANTS	**SOIL FERTILITY**
.Macro-and micro-nutrients Nitrogen, Potassium, Sulphur, Magnesium, Phosphorous, Iron, Calcium, Zinc	.Role of macro-nutrients: Nitrogen, Potassium, Sulphur, Magnesium, Phosphorous
SYMBIOSIS AND PARASITISM	**PARASITISM IN LIVESTOCK**
.Endo- and Ecto-parasites: tapeworms-Taenia Solium and Taenia Saginata	.External and internal parasites: Ticks, roundworms and tapeworms

Source: Adapted from Kenya National Examinations Council Regulations and Syllabus, 1991-1992.

The broad nature of the syllabus was not confined to Biological Science. It applied virtually to all the subjects offered in the 8-4-4 curriculum. Like the biology teachers, the other teachers too, had to rush, in an attempt to cover the syllabus in readiness for the final KCSE examination. This put a lot of pressure on the students as they strove to cope with all 10 subjects offered in the final KCSE examination. One common practice which was observed among all the teachers in the two schools studied was that after teaching in class, each one of them gave prepared notes to the students, through the respective class monitors. The notes were to be copied at the students' "free" time. But due to overwhelming work on students, there was no free time. Students were thus observed copying notes during evening prep, lunch breaks, and weekends. As a result, there was hardly any time left for students to do their homework, individual study or to simply relax their tired minds. This had far reaching implications on the mastery of the subjects including biological science.

4.4.3. Clarity of Goals.

"Lack of clarity about goals and means, that is, diffuse goals and unspecified means of implementation is a perennial problem of curriculum change" (Fullan, 1982, p.256).

The four teachers in the study reported that the goals and

objectives of the biological science curriculum were clear. The use of explicit terms to state the objectives might account for this belief. For most topics, explicit terms such as state, relate, list, compare, explain, describe, outline, distinguish, name, define and so on were used extensively. The use of such words seemed to leave nothing merely implied; hence the perceived clarity of the objectives.

A closer look at the KNEC regulations and guidelines revealed, however, that there were instances when meaning was not clear. For instance, in Form III (topic: Ecology), one performance objective stated "the learner should be able to identify food chains, food webs, and biogeochemical cycles" (p.251). In the same Form (topic: Reproduction) another objective stated that they should be able to "identify symptoms, methods of transmission and prevention of sexually transmitted diseases" (p.254). It is clear in both these instances that the "identification" requires a significant amount of explanation. However, in Form IV (topic: Genetics), another objective stated that the students should be able to "identify chromosomes in permanently prepared slides of cells" (p.257). The use of the word "identify" here implies response to a visual stimulus, and thus shows the inconsistency with which the word is used in the curriculum. The teachers, however, seemed to interpret correctly the use of the word and

appeared to do the right thing in either instance.

Shayer and Adey (1981) provide an explanation for this perceived clarity. In a study of the Nuffield Combined Science Curriculum, they noted that the curriculum did not have behavioral objectives spelled out for each activity. However, "from the general description of what is expected to be achieved by each activity, and by the simple expedient of asking "What is the point of doing that?" one can specify the implied objectives closely" (p.50). This deductive strategy seemed to apply well to the teachers in the case study and might explain why they felt that all the objectives of the curriculum were stated clearly.

The means of achieving the stated objectives were also reported as being clear. But while the means of achieving the objectives were clear, it was not always easy to use them due to the unavailability of resource materials for teaching.

4.5 In-service training.

All four teachers in the study were professionally trained. The two biology teachers in school A held B.ED (Science) degrees. In school B, one teacher held a B.ED (Science) degree and the other had a DIP. ED (Science) diploma. Teachers trained at the university level during which they study two secondary school teaching subjects and

education for three years (old 7-(4-2)-3 system) or two secondary school teaching subjects plus education for four years (new 8-4-4 system) receive a B.ED. degree. Teachers classified as DIP.ED. holders have taken education and two teaching subjects at a diploma teachers training college for a period of three years.

Although pre-service training is important, in-service training is even more important especially when new curricula such as the 8-4-4 curriculum have to be implemented. Fullan (1982) states this succinctly: " When teachers engage in professional development activity, they are partaking in something which raises and/or advocates the possibility of changes in beliefs and behaviour with all that this might involve regarding new theories, knowledge, and skills in attempting to improve practice" (p.262). In-service courses provide an opportunity for teachers to interact with each other, share ideas, and help one another. In-service training is therefore important in the event of educational change because such a change usually renders current practices obsolete or relatively ineffective.

Despite its importance, the study found that in-service courses in the 8-4-4 system of education were rather rare and/or of short duration. One biology teacher in school A had attended such a course a year before the study. He preferred to call it a seminar rather than a course since it lasted less than a day. The seminar was held at one of the

schools near the district headquarters where a number of teachers met.

The content that was covered included suitability of subject matter at different levels, sequencing topics at different levels, and the nature of problems faced in the implementation of the subject. The participating teachers made and discussed some recommendations regarding the current syllabus. The recommendations focused on the above topics. A questionnaire from the Ministry of Education Inspectorate was also completed by the teachers. Reportedly, it dealt mainly with issues pertaining to the problems the teachers encountered as they tried to implement the biological science syllabus. Their opinions on how to implement better the curriculum were sought. However, the teachers had not received any feedback from the Ministry regarding the questionnaire.

A very similar situation prevailed in school B. One of the biology teachers had attended a meeting with a number of biology teachers from other schools in the district. The meeting had little to do with in-service training per se but the biology teachers had an opportunity to discuss some of the problems they faced when implementing the curriculum. Issues such as class size, broadness and difficulty of the content, shortage of textbooks, and the lack of sufficient funds for field trips and projects were discussed. However, these discussions were outside the meeting's agenda which

was mainly to set and compile Biology papers for the district "mock" examination. The mock examination is aimed at gauging how well the Form IV candidates might perform in the final KCSE examination, a competitive nation-wide examination sat for by all Form IV students in the country.

In sum, it appears that there were actually no serious in-service courses in the 8-4-4 system to aid the teachers in classroom instruction. The aims of the meetings and/or seminars attended by the teachers in the study appear to diverge considerably from the traditional purpose of in-service courses, namely providing ongoing interactive cumulative learning necessary to develop new conceptions and skills.The meetings seemed to be more concerned with discussing the problems related to the implementation of the biological science syllabus. But while it was evidently clear that the teachers knew the problems that they encountered during the implementation of the curriculum, there were no concrete suggestions as to how to go about solving them in class. Moreover, most of the problems cited by the teachers demanded some finance, a very scarce resource in the two schools of the study.

4.6 Teacher-teacher Relationships.

"School improvement is most surely and thoroughly achieved when teachers engage in frequent, continuous,

> and increasingly concrete and precise talk about teaching practice... By joint work on materials, teachers share the considerable burden of development required by long-term improvement, confirm their understanding of their approach, and make raising standards for their work attainable by them and by their students" (Little, 1981, p.12).

The four teachers in the study reported that they exchanged ideas regarding the teaching of Biological Science. Those in school A said that the exchange occurred "when they both had free lessons". The teachers in school B reported that they shared ideas about the teaching of the subject "when there was a problem related to the subject, such as a question to be solved". The ideas were shared mainly in the staff room or in the laboratory by the teachers in each of the two schools.

In spite of their strong conviction that they shared ideas about teaching the subject, observation revealed that the biology teachers interacted with each other rather infrequently. The interaction observed seemed not so much related to the "hows" of the teaching of the subject as to helping out especially when there was some heavy work to be accomplished. In this particular respect, the teachers in school B appeared to be more co-operative than those in school A. They helped each other in assembling laboratory apparatus/equipment or materials in preparation for

laboratory classes. This was rarely observed in school A where each teacher appeared to keep aloof, minding his own business. The absence of a laboratory assistant in school B might explain the biology teachers' co-operative nature. If they had to cope up with the heavy burden facing them, then they had no choice but to co-operate. In the absence of a laboratory assistant, one teacher helped the other with the expectation that the other would reciprocate appropriately when the right time came.

What could be described as a real interaction of biology teachers in both school A and school B was observed towards the end of the term when they were preparing to administer the end of term examinations. At that time, the teachers worked together very closely in deciding the format of the examination, number of examination papers to be set, number of questions in each paper, and the duration for each paper. They even sat down together to draw marking schemes for the examination papers. This was the time when real interaction occurred; one teacher in school A even helped the other to mark some of the Form III examination papers.

4.7 The Role of The Principal.

The two head teachers were asked to rank certain tasks on a 1-5 scale indicating the tasks that took most of their time and those that took the least time. The tasks ranked 1

took the least time and those that were ranked 5 took most time. Table 4.5 illustrates the relative time that the two head teachers spent on those tasks.

TABLE 4.5

DATA TABLE OF HEADMASTERS' RATING OF TASKS.

TASKS	SCHOOL A	SCHOOL B
(a) Dealing with correspondence	5	2
(b) Attending to disciplinary problems	5	3
(c) Attending to care and renovation of school buildings	3	5
(d) ordering school supplies	4	3
(e) Supervision of instruction	2	2
(f) Securing finance for the school	3	4
(g) Doing my own classroom teaching	2	2
(h) Attending professional seminars	1	1

1=tasks taking the least time.

5=tasks taking the most time.

The biology teachers reported that the head teachers of the two schools played a limited role in actual instructional management. Despite the Ministry of Education's recommendation that head teachers supervise their teachers during instruction, actual classroom

instructional supervision in the two schools was not observed at all throughout the study. The head teachers had hardly any time as instructional leaders because most of their time was spent on administrative matters. Occasionally, however, they walked through the school corridors taking quick glances into the classrooms. This indirect strategy was not instructional supervision as such but it served to monitor those teachers who skipped lessons.

A closer scrutiny of teachers' work was reflected in the head teachers' checking of teachers' records of work--what they had covered in class within a period of time. The two head teachers expected their teachers to present records of work through their respective heads of departments. Headmaster A checked the records of work on a weekly basis while headmaster B checked them at monthly intervals. But the exercise appeared to be a formal administrative routine task. A date and a signature (headmaster's) on the teachers' records of work book seemed to suffice, indicating that the headmaster had performed his duty. This would be handy if the school inspectorate personnel visited the school for inspection. The headmasters rarely counter-checked the teachers' records of work against the respective schemes of work to see whether their teachers were actually teaching what they had planned in the course of the term.

The headmasters spent most of their time on administrative matters, specifically dealing with

disciplinary problems and paper work. They also devoted some time to their own classroom instruction. Headmaster A taught a total of 10 lessons in Kiswahili and Geography per week while headmaster B taught 6 lessons in History and Social ethics per week. The head teachers also spent considerable time ordering school supplies: food, exercise books, school uniform, games equipment, and office stationary.

Both the head teachers spent relatively high proportions of time trying to secure finance for their schools. Frequent visits to the district education office was common practice by the two head teachers, who went there to inquire about grants in aid and also to solicit for some more teachers. The provision of these was not always guaranteed at the district office, a fact that forced the head teachers to go to the national headquarters in pursuit of them.

The study also found that attending professional seminars by the head teachers of the two schools was rare. The headmaster of school A reported that he had not attended any professional seminar in the 2-year period he was headmaster. The headmaster of school B had attended one seminar that was organized by the Kenya Education Staff Institute (KESI). The seminar was a residential one that lasted a duration of 2 weeks. It was characterized by both an intensive and extensive programme that dealt with various aspects of educational administration such as: school

discipline, financial management, delegation, staff development and motivation, physical planning and development, evaluation of performance, decision making and problem solving, guidance and counselling, legal provisions in education, and communication as a tool of management. The headmaster reported that his attending the seminar was beneficial in that it had resulted in his changing considerably his administrative practice in a more positive direction.

From what has been discussed in the preceding section, it is apparent that most of the tasks that the head teachers of the two schools under study were involved in were related rather remotely to direct instructional management. The overwhelming emphasis of their daily work was oriented toward maintenance, specifically attending to disciplinary problems, ordering school supplies, securing resources for the school, and dealing with correspondence. Under these circumstances, the head teachers could not be effective instructional leaders.

The two head teachers were also asked to rank a set of factors that may contribute to problems with the implementation of the biological science curriculum in their schools. The scale that was used represented a continuum of possible contributions ranging from NO PROBLEM (1) to A MAJOR PROBLEM (5). Table 4.6 presents the head teachers' responses.

TABLE 4.6

HEADMASTER RATINGS OF FACTORS THAT HINDER IMPLEMENTATION.

	SCHOOL A	SCHOOL B
Transfer of biology teachers	1	1
Short teaching experience	1	1
Inadequate supply of materials	5	5
Low professional qualifications	1	3
Absence or few in-service courses	5	5
Poor quality in-service courses	5	5
Shortage of biology teachers	1	4

1=Factors seen as being no to implementation.
5=Factors viewed as being major problems to implementation.

The head teachers of the two schools perceived the inadequate supply of materials/equipment, absence or few in-service courses, and poor quality in-service courses as being major problems to the implementation of the biological science curriculum. Unlike the head teacher of school A,

that of school B, saw the shortage of biology teachers and low professional qualifications as being a problem in the implementation process. This was the case because only 2 biology teachers handled 365 students in school B unlike 183 students in school A for the same number of biology teachers. In addition, one of the biology teachers in school B had a lower qualification in that he was a Dip. ED holder while the two teachers in school A had B. ED (science) degrees.

The two head teachers did not view the transfer of biology teachers or short teaching experiences as being problems to implementation.

From the responses of the biology teachers and head teachers, and observations by the researcher, it was apparent that the five factors identified in the literature as being crucial to curriculum implementation were not working strongly in favour of implementation in the two schools of the study. However, some of them posed a greater hinderance to implementation.

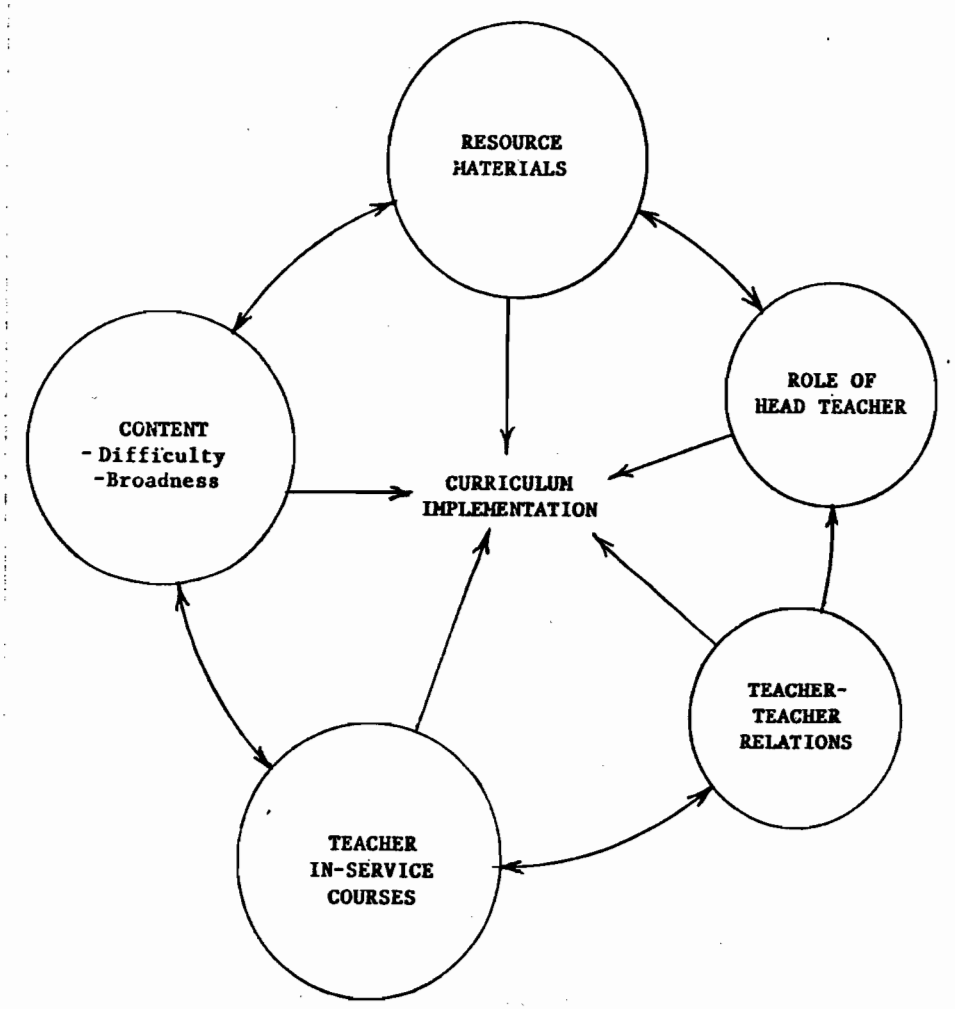
Three of the five factors were singled out as major stambling blocks to implementation. These were: lack of resources, absence of in-service courses, and difficulty and broadness of the subject matter.

A conceptual model (Figure 2) can be proposed to depict the importance of the five factors in curriculum implementation. In the visual representation in Figure 2, it

should be interpreted that the bigger the circle, the greater the importance of the variable in implementation. Conversely, the smaller the circle, the less influence the variable has on implementation.

FIGURE 2

CRITICAL VARIABLES IN IMPLEMENTATION: A CONCEPTUAL MODEL.



CHAPTER FIVE.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction.

The literature reviewed on implementation identified 5 specific variables as being important in the implementation process. The variables are: 1. Resources, 2. Difficulty of content and clarity of goals, 3. In-service training, 4. Teacher-teacher relationships, and 5. The role of the principal. Using these 5 variables, the implementation of the 8-4-4 biological science curriculum was explored. This chapter summarizes the findings of the study and presents some recommendations for practice and for research.

5.2 SUMMARY AND CONCLUSIONS.

5.2.1 Resources.

The study found that although the two schools in the case study had general laboratories used for teaching Agriculture, physical and biological sciences, the laboratories were generally poorly equipped. Most of the items considered necessary for the teaching of biological science were available in the laboratories of the two schools

but they were invariably inadequate. This finding was consistent with the studies by Berman and Pauly (1975), Gross et al. (1971), and Maundu (1986) which found inadequate materials and equipment as being problems to implementation. The biology teachers resorted to lecturing and occasional demonstrations due to the inadequacy of materials, apparatus and/or equipment. Students were thus exposed to a limited number of laboratory sessions despite the fact that such sessions are crucial to students' success in the KCSE national examination.

Textbook availability as a resource was also considered in the study. The study found that, similar to the findings of Heyneman (1981), and Maundu (1986) the number of textbooks were too few in the two schools resulting in the sharing of a single book by many students. Apart from the small number of textbooks in the two schools, the study found that the textbooks were of poor quality since their coverage of some of the topics was reported as being shallow. This was found to be a major cause of discontent among the biology teachers who viewed both the small number and the poor quality of textbooks as being a problem in the implementation process.

Concern about textbook availability and the availability of other instructional materials was evidently not confined to the two schools of the study. There was a strong public concern about it too. This came through particularly after the announcement of the first KCSE results

under the 8-4-4 system of education in February, 1990. The number of articles that appeared in the local dailies was indicative of this public concern. The articles were carried mainly in two local dailies: the "Daily nation" and the "Standard". For instance, the Standard, Thursday, April 5, 1990 had the article--"lacking textbooks affects greatly on KCSE failures"; Daily nation, Saturday, March 24, 1990 carried the article--"Books a stumbling block in 8-4-4"; Daily Nation, Wednesday, April 4, 1990 had the article--"Schools lack the vital facilities" and the standard, Friday, March 30, 1990 carried the article--"Identify textbooks for 8-4-4 system to avoid cramming". One of these articles has been included (see appendix F). Some readers even went to the extent of suggesting solutions to the problems encountered under the 8-4-4 system. A short article titled "Tips to solve the 8-4-4 hitches" appeared in the Daily Nation, Saturday, March 24, 1990.

The finding on resources seems to contradict the study findings on American schools by Coleman et al. (1966) and that on British secondary schools by Rutter (1979) which found no relationship between resources and student success. The reason for this apparent contradiction is that in comparison to Kenya, America and Britain are developed and therefore in a better position to provide more instructional materials to their schools. In contrast, serious financial constraints exist in developing countries such as Kenya whose

remarkable expansion in education has put even more pressure on her meager resources to the extent that providing simple apparatus to the schools becomes difficult to meet.

5.2.2 Difficulty of content and clarity of goals.

The study found that certain concepts beyond the students level of understanding were introduced prematurely especially at the lower secondary level. It singled out 3 major topics where the content was evidently too advanced for the learners. *Classification*, *Respiration*, and *Photosynthesis* were found to have difficult content for the Form I and Form II students. This finding was consistent with that of Tamir (1978) who found that many curriculum projects under-estimated the complexity and difficulty of the subject matter, on one hand, and over-estimated the students' ability to comprehend the scientific skills on the other hand. But unlike the studies by Aoki et al. (1977) and Charters and Pellegrin (1973) where they found that clarity of goals was a major problem in the implementation process, the present study found no ambiguity in the clarity of the curriculum's goals and objectives because teachers were able to interpret the goals and objectives correctly.

The study also found that the syllabus was too wide to be covered in time for the KCSE national examination. Due to the importance attached to this examination, the teachers

rushed to cover the syllabus; adopting the lecture method most of the time because this was considered the most efficient way to transmit the necessary information within the short time available. This was done at the expense of the students' mastery of the content covered. A similar finding was reported by Hauwiller (1981) who coined the term "mastery/coverage" dilemma for the phenomenon. He noted that in many curricula, there is always the danger that neither coverage nor an appropriate mastery of content is achievable to the satisfaction of the teachers due to the large amount of material to be covered.

5.2.3 In-service training.

The study found that there were actually no serious in-service courses for the biology teachers. Instead, they attended brief meetings mainly to set mock examination papers. During such meetings, the biology teachers also discussed the problems that they encountered when implementing the subject. But the discussions were invariably informal and without the guidance of professional trainers as would be expected of in-service courses as we know them. As a result, there were no concrete practicable solutions offered to address implementation problems in actual classroom instruction situations. The meetings were therefore ineffective in this respect. This finding was similar with

that of Tamir (1978) who found the insufficiency of in-service courses for teachers as being a main reason for unsuccessful implementation.

5.2.4 Teacher-teacher relationships.

The study found that the biology teachers in school B had closer relations with each other than those of school A. But generally, the biology teachers in the two schools of the study interacted with each other very infrequently. A real interaction was observed towards the end of the term when the teachers were preparing to administer the end of term biological science examination papers.

5.2.5 The role of the principal.

The study found that, similar to the findings of Leithwood and Montgomery (1981) and Fullan (1982), the head teachers of the two schools in the study played a limited role in actual classroom supervision of instruction. However, they checked the teachers' records of work but they did not provide their teachers with helpful academic and/or professional advice. The head teachers spent most of their time in administrative tasks such as student disciplinary control, and dealing with correspondence.

The study also found that the two head teachers were

actively involved trying to secure resources for their schools in form of finance and additional teaching staff. One of the teachers had attended a professional seminar that dealt with a wide range of topics related to administration.

5.3 RECOMMENDATIONS FOR PRACTICE.

The main problem in the implementation of the biological science curriculum as found by the study stems from the lack of funds for the purchase of resources, training personnel, and constructing additional infrastructure. In order to improve implementation, it is therefore necessary to look for ways aimed at generating more funds. In addition, extra time should be sought for satisfactory coverage of the syllabus, preparation of teaching materials, and for in-service training of teachers.

At present, the government provides substantial support to government-maintained schools. In order for it to provide more grants to assisted schools, the government should reduce its subsidies to the more established government-maintained schools and reallocate the funds to the relatively poorer government-assisted schools. This would partially fulfil one of the aims of the 8-4-4 system regarding equitable allocation of resources across institutions at the secondary school level (Republic of Kenya, 1984).

Secondary school head teachers should enforce more

effectively the government's cost-sharing policy. Through this strategy, parents/guardians should provide learning resources for their children. In addition, an effort should be made to provide better quality textbooks and to expand the variety of reference books for both students and teachers.

Secondary school heads and board of governors should capitalize on the popular "Harambee" spirit prevailing in the country. Through this, fund raising drives can be organized for purchase of science equipment, and textbooks. Each district should have a plan of action with regard to harambee meetings that should give special preference to the poorer Harambee and government-assisted secondary schools.

District education officers should organize in-service courses for teachers. In order to meet the needs of the teachers, such courses should be geared toward teacher-specific training activities and should provide an ongoing continuous teacher assistance and support during implementation. Thompson and Cooley (1984) emphasize that "the bottom line is that if student achievement is to be improved teachers must have in-service training" (p.1).
At the individual school level, schools should engage in money-generating activities. A case in point would be for schools to indulge more actively in farming by growing crops or raising livestock. This would reduce a school's need to buy food and revenue saved could then be channelled to something else such as the purchase of laboratory equipment

or textbooks.

Another major step in improving the quality of implementation would be to provide head teachers with professional training aimed at enabling them to innovatively implement the curriculum and maintain instructional integrity. According to the teachers in the study, apart from the checking of records of work by the head teachers, the biology teachers did not receive any academic or professional advice from their heads. The same applies to the officials of the Inspectorate division who rarely indulge in the supervision of teaching when they visit the schools. Maranga (1979) attributed this lack of supervision to the fact that the present responsibilities of school inspectors like those of head teachers emphasize administrative functions.

The difficulty of content was one factor that caused poor implementation of the biological science curriculum. In order to alleviate this, there is a need to reshuffle the order of topics in the present syllabus. This may mean avoiding "Classification" until Form II, postponing "Respiration" and "Photosynthesis" until Form III, Shifting "Reproduction" to Form I, moving "Breathing" to Form I or Form II and so on. This whole exercise might necessitate the re-sequencing of the entire syllabus.

The biological science syllabus was reported to be too wide for coverage within the stipulated time. One reason for this as revealed by the study was that there existed an

overlap of some of the topics within the subject itself and also between Biology and Agriculture. There is therefore a need to merge the overlapping topics within biological science and to avoid the duplication that was observed in Agriculture. For example, there is no need to teach "Bio-geochemical cycles" or "Asexual reproduction" in Biology and then in Agriculture again to the same students. This merely repeats the same concepts and makes the syllabus even broader.

Another way to cover the syllabus adequately is to reduce the duration for the vacations by teachers and students. The holidays seem to be unnecessarily long; taking a total of 13 weeks of the school year: 3 weeks during the Easter holidays, 3 weeks in August, and 7 weeks during the Christmas holidays. The extra time could then be used for in-service training and for the preparation of teaching materials such as charts. In addition, the starting time for the KCSE national examinations should be shifted from October to November, thus affording some extra time for the activities suggested above. These two suggested recommendations would go a long way in providing additional time for improving implementation.

5.4 RECOMMENDATIONS FOR RESEARCH.

The present study looked at the implementation of biological science in two government-assisted secondary schools in Kenya. Since there are other categories of schools, it seems that the next step would be to look at those other types of schools to find how they are implementing the biological science curriculum. This will provide a base for comparing implementation in the four categories of secondary schools in Kenya.

As well, such a study should look at schools with good results and compare the methods used in teaching (beyond resources, teacher qualification etc.) in an attempt to find what good teachers do to get around lack of resources. The primary sources of data in the case study were the head teachers and the biology teachers of the two schools. Extra information that would shed more light into the implementation process could also be obtained from the students in particular about the problems they are faced with as they (students) try to comprehend the concepts being presented to them by their biology teachers. In addition, probing the role of the parents and the board of governors could provide a more detailed picture of the process of implementation.

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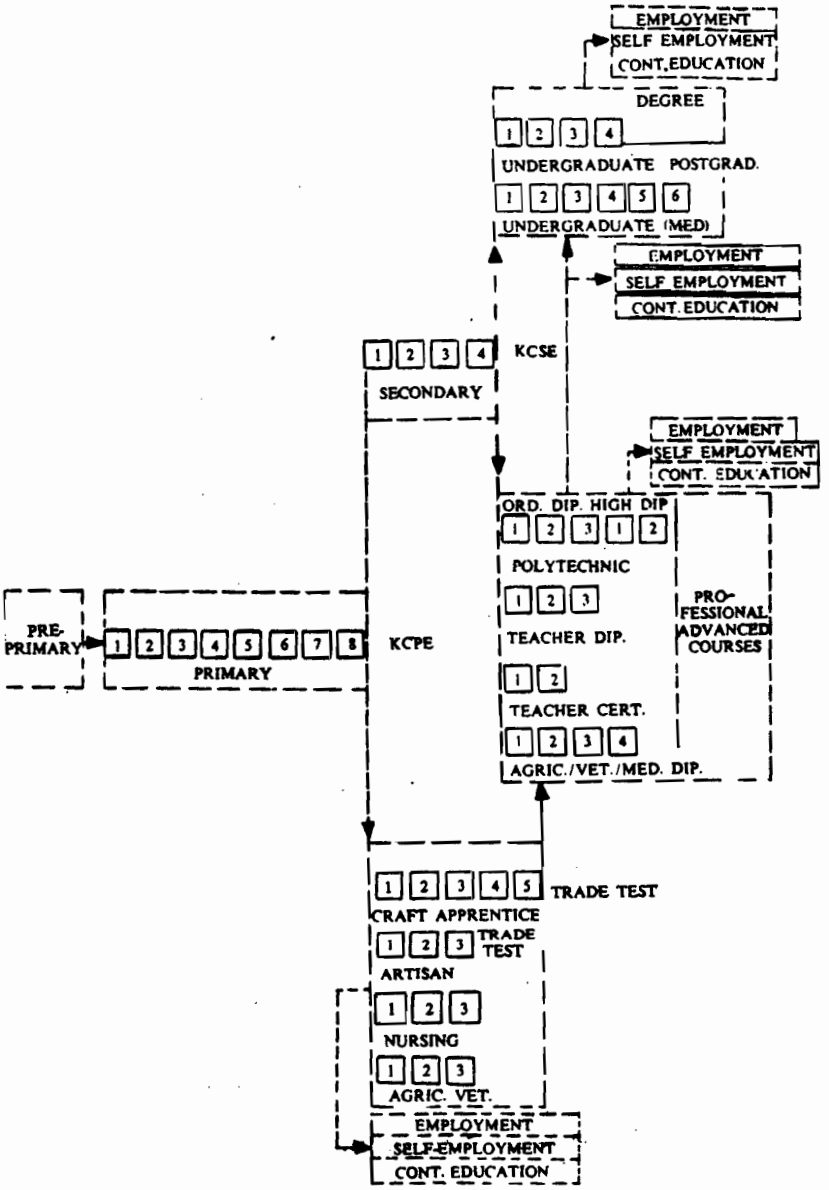
APPENDIX A

STUDENT FLOW UNDER THE 8-4-4 SYSTEM



KEY:

1 Year

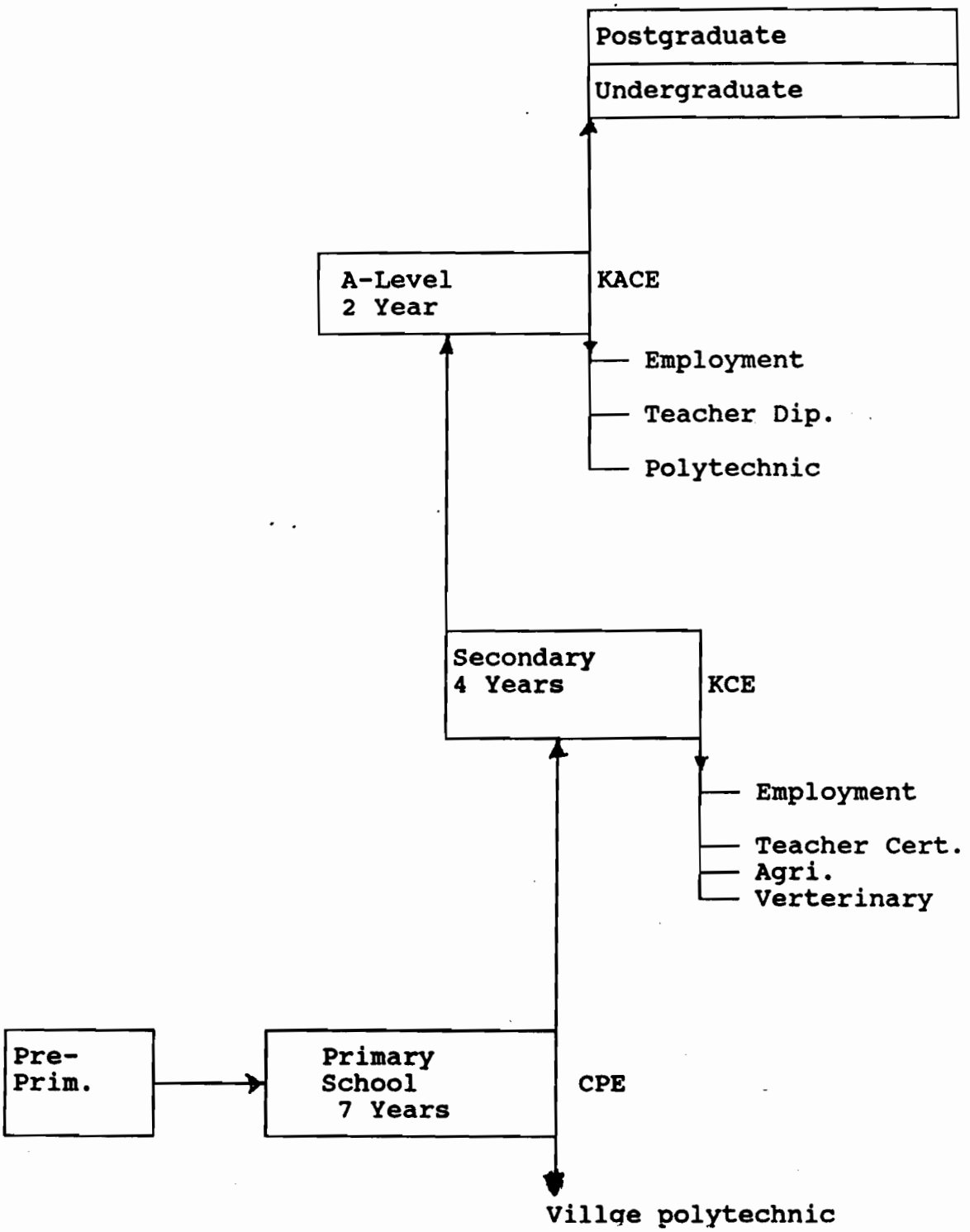
→ Possible route for student

KCSE Kenya Certificate of Secondary Education

KCPE Kenya Certificate of Primary Education

APPENDIX B

STUDENT FLOW UNDER THE 7-(4-2)-3 SYSTEM



KEY:

→ Possible route for student
KACE Kenya Advanced Certificate of Education
KCE Kenya Certificate of Education
CPE Certificate of Primary Education

OFFICE OF THE PRESIDENT

DISTRICT COMMISSIONER'S OFFICE
BARINGO DISTRICT
P.O BOX 1
KABARNET

Ref.No. ADM.15/14/Vol.III/51

10th January, 1991.

DISTRICT COMMISSIONER BARINGO
File.....
KABARNET

All District Officers
BARINGO

RE: RESEARCH AUTHORIZATION

KELWON ISAIAH KIPROP

The above named student has been cleared by office of the President vide research permit No.OP.13/001/20C 121 dated 3rd January, 1991 to conduct research in Baringo District on the topic;

"The implementation of the 8:4:4 Biological Science Curriculum at Secondary School Level"

The permit will expire on 31st March, 1991.

The purpose of this letter is to ask you to give him the necessary assistance when he calls on you.

(OLANDO, P.P)
For: DISTRICT COMMISSIONER
BARINGO

DISTRICT COMMISSIONER BARINGO

c.c Permanent Secretary/Adm.,
Office of the President,
NAIROBI

Provincial Commissioner,
Rift Valley Province,
NAKURU

Kelwon Isaiah Kiprop,
P.O Box 79,
KABARNET

APPENDIX D

SECONDARY SCHOOL ADMINISTRATOR'S QUESTIONNAIRE.

The purpose of this questionnaire is to find out how then new 8-4-4 biological science curriculum is being implementd at the secondary school level. Your school has been selected for this study which will involve you and your biology teachers. Pleate complete the questionnaire. You are kindly requested to give honest responses. Any information that you supply will be treated as confidential.

1. (i). What is the total number of teachers in your school

.....

(ii). Number of male teachers .....

(iii). Number of female taechers .....

2. How many biology teachers do you have in your school?

.....

3. (i). What is the total number of students in your school?

.....

(ii). Number of female students .....

(iii). Number of male students .....

4. What subjects do you teach ?

....

5. How many lessons do you teach per week? .....

6. How much do you think each of the following factors may

contribute to problems with the implementation of the biological science curriculum in your school? Mark (X) the appropriate box. The numbers represent a continuum of possible contributions to problems ranging from A MAJOR PROBLEM (5) to NO PROBLEM (1).

	5	4	3	2	1
(a) Transfer of science teachers to other institutions	( )	( )	( )	( )	( )
(b) Short teaching experience (< 4 years)	( )	( )	( )	( )	( )
(c) Inadequate supply of biological science materials/equipment	( )	( )	( )	( )	( )
(d) Teachers with low professional qualifications for teaching biology	( )	( )	( )	( )	( )
(e) Absence or few in-service courses	( )	( )	( )	( )	( )
(f) poor quality in-service courses	( )	( )	( )	( )	( )
(g) Shortage of biology teachers	( )	( )	( )	( )	( )

7. Rank the following tasks from 1-5 to show which ones usually take the most time and which ones take the least time. Tasks taking most time should be ranked 5. Tasks taking the least time should be ranked 1. Other tasks should be ranked 2, 3, or 4 depending on the amount of time they take up. No number may be used more han 3 times.

TASK	RANK
(a) Dealing with correspondence	....
(b) Attending to disciplinary problems	....
(c) Attending to care and renovation of school buildings	....
(d) Oredering school supplies	....
(e) Supervision of instruction	....
(f) Securing finance for the school	....
(g) Doing my own classroom teaching	....
(h) Attending professional seminars	....

8. (a) Does your school have a library?

Yes ( ) No ( )

(b) If yes, what is the number of volumes for biology?

.....

9. Approximately how much does your school spend, percentagewise, out of your total school budget, on biology materials/equipment? .....

10. How do you find the budget allocation for these materials?

(a) adequate ( )

(b) barely adequate ( )

(c) inadequate ( )

11. What are the major sources of funding for your school?

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

12. What is your age?

	Early	Mid	Late
Thirties	.....	...	....
Forties	.....	...	....
Fifties	.....	...	....

13. What would enable you and your teachers to improve the implementation of the biological science curriculum in your school? (Please be detailed)

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APPENDIX E

SECONDARY SCHOOL BIOLOGY TEACHER QUESTIONNAIRE.

The purpose of this questionnaire is to find out how the new 8-4-4 biological science curriculum is being implemented at the secondary school level. Your school has been selected to participate in this studywhich will involve you and your head teacher. Please complete the questionnaire. You are kindly requested to give your true opinion. Any information that you supply will be treated as confidential.

1. What diplomas or degrees do you hold?

   S1 ( ) Dip. Ed ( ) Bsc. ( ) Bsc. and Dip. Ed ( ) etc.

2. For how many years have you taught biology? .....

3. (i). When was the last time you attended an in-service course in biology since the 8-4-4 system was started?

   (a) less than a year ( )

   (b) a year ago ( )

   (c) two years ago ( )

   (d) three years ago ( )

   (e) more than three years ago ( )

(ii) How long did you spend at each course?

   (a) one day ( )

   (b) 2-3 days ( )

   (c) one week ( )

   (d) more than a week ( )

4. What was covered at the course?

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5. How often do you use the following methods to teach biology? Put a tick inside the box which best represents the frequency of each method you use.

	Frequently	Occasionally	Rarely	Never
(a) Lecture to whole class	( )	( )	( )	( )
(b) Lecture accompanied by audio-visual aids	( )	( )	( )	( )
(c) Demonstration of lab. activity	( )	( )	( )	( )

	Frequently	Occassionally	Rarely	Never
(d) The class is divided into small groups who work on laboratory activities	( )	( )	( )	( )
(e) The whole class goes on field trips	( )	( )	( )	( )

6. Do you divide your class into small groups for project work or assignments?

	Project work	Assignments
(a) Yes, frequently	( )	( )
(b) Yes occasionally	( )	( )
(c) No	( )	( )

7. About how long does it take you to prepare for:

(a) a laboratory lesson ..... Hours

(b) a non-laboratory lesson ..... Hours

(c) project class ..... Hours

(d) field trip ..... Hours

8. What kind of laboratory do you have in your school?

(a) Chemistry ( )

(b) Biology ( )

(c) Physics ( )

(d) Physical science ( )

(e) General laboratory (for biology, chemistry, and physics) ( )

(f) Home science ( )

(g) None ( )

9. If you have a laboratory that you use for biology, tick those laboratory items that are generally adequate, inadequate, or not available throughout the year.

Laboratory item	Adequate	Inadequate	not available
(a) Dissection kits	( )	( )	( )
(b) Microscopes	( )	( )	( )
(c) Microscope slides	( )	( )	( )
(d) Permanent slides	( )	( )	( )
(e) Tissue/cell stains	( )	( )	( )
(f) Live specimens for dissection	( )	( )	( )
(g) Preserved specimens	( )	( )	( )
(h) Water trays	( )	( )	( )
(i) Quatrats	( )	( )	( )
(j) Iodine	( )	( )	( )

Laboratory item	Adequate	Inadequate	not available
(k) Millons reagent	( )	( )	( )
(l) Benedicts solution	( )	( )	( )
(m) Chloroform	( )	( )	( )
(n) Hand lenses	( )	( )	( )
(o) Potometers	( )	( )	( )
(p) Enzymes	( )	( )	( )
(q) DCPIP	( )	( )	( )
(r) Charts	( )	( )	( )
(s) Models	( )	( )	( )

10. How many student work stations do you have in the laboratory you use for biology? .....

11. Does your school have a laboratory technician?

Yes ( ) No ( )

12. How many textbooks do you have for the classes that you teach biology? .....

13. What is the number of students in the class(es) that you teach biology? .....

14. Do you exchange ideas about the teaching of biology with your colleagues?

Yes ( ) No ( )

15. if the answer to Q. 14 is yes, when do you exchange the ideas about the teaching of biology with your colleagues?

(a) at tea break

(b) during staff meetings

(c) during departmental meetings

(d) other (specify)

16. What would enable you to improve theimplementation of biological science in your school? (Please be detailed)

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DAILY NATION, WEDNESDAY, APRIL 4, 1990

Leaders should not blame teachers

The *Daily Nation* of March 19 reported the Minister for Livestock Development, Mr Elijah Mwangale, as saying that teachers and education officials, who were lax in their duties, were to blame for falling standards of education in Bungoma District.

First and foremost, these leaders should ask themselves why Bungoma has always lagged behind in academic circles. The 8-4-4 system is to blame for mass failures and not teachers. Teachers have been working round the clock to see that students excel in their examinations.

As Mr Mwangale put it, the 8-4-4 system is a pragmatic approach foundation to make Kenya an industrial power in Africa.

However, to teach science without practical work, would be like teaching swimming in the classroom without ever visiting the swimming pool.

Leaders should stop pointing accusing fingers at teachers. They should co-operate with academicians in the district to find out the major causes of the KSCE mass failure.

They are the ones who should play a major role in improving education standards by, for instance, soliciting funds to buy what is lacking in most schools. Such a move would encourage teachers to work even harder instead of discouraging their efforts.

Criticism does not solve the problem. It would instead lead to disheartened teachers moving to other districts.

Those of us, who come from the district and were students there, know that academic performance has been poor due to some of the following reasons:

- Lack of facilities such as laboratories and workshops which are very essential for any school to excel in the 8-4-4 system.
- Embezzling of school funds by school heads.
- Lack of modern equipped libraries in most schools.
- Many Harambee schools offer low quality education because the quality of students, who enter such schools is low and most of the teachers untrained.
- Poor management of schools due to political and church influence. Politicians have a tendency of using schools as campaign platforms to an extent that when a new politician comes on the stage, he comes with new management plans.

I appeal to these leaders that it is high time they formed a probe committee consisting of scholars, to find solutions to this education upheaval in the district out than waging a war of words on teachers and education officials.

There is very little or no room for any immediate improvement without addressing themselves to these problems.

Musa wa Khaemba,
University of Nairobi

The Editor welcomes brief letters from readers on topical subjects. They will be considered for publication only if they carry the writer's signature and box number, not necessarily for publication, but as a sign of good faith. The paper reserves the right to shorten letters. Write to: The Editor, Daily Nation, P.O. Box 49010, Nairobi.

Schools lack the vital facilities

The recent introduction of the 8-4-4 system of education had very good motives, but there was lack of funds to implement it to its full potential.

It is important for us to note that our primary schools have five million pupils with an average of 625,000 pupils per class, who will graduate every year.

In the recent KCSE results, there were mass failures in sciences, mathematics and English, which happen to be the most important subjects in our country.

Failure in science subjects was attributed to lack of facilities whereby some candidates were handling apparatus for the first time during examinations.

However, success in technical subjects was attributed to the fact that they were offered by well established schools with good facilities.

The need for well equipped laboratories and workshops becomes obvious. However, I believe it is too much to expect every secondary school to put up these facilities as the financial strain would be too much on the parents.

I challenge every development conscious Kenyan to support the idea of having fully equipped science laboratories and workshops in every constituency in the country. These facilities should not belong to any particular school but should be shared among all the different schools there.

Students can have their theoretical studies in their respective schools and only use these facilities for practical lessons on rotational basis.

Workshops can be built for the various technical subjects while laboratories should be for science subjects.

This will bring out the manpower and brains our country needs in universities polytechnics and institutes of technology to produce high calibre technology.

While job opportunities are few in industries, the public sector and *jua kali*, we can start exporting manpower while encouraging the growth of industries in our country.

'Concerned,'
Nairobi