



**Science, Mathematics and ICT (SMICT) education  
in Senior Secondary Schools in Ghana  
Preliminary report**

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## List of abbreviations

Asanco	Asankrangwa Secondary School
BECE	Basic Education Certificate Examination
CAS	Continuous Assessment System
CRDD	Curriculum Research and Development Division
FCUBE	Free, compulsory Basis Education
GER	Gross Enrolment Rate
GES	Ghana Education System
ICT	Information, Communication and Technology
JSS	Junior Secondary School
MoE	Ministry of Education
NGO	Non-Governmental Organisation
SEAI	Secondary Education in Africa
S(S)SCE	Senior (Secondary) School Certificate Examination
SMICT	Science, Mathematics and ICT
SRC	Science Resource Centre
SSS	Senior Secondary School
STME	Science, Technology and Maths education
WAEC	West African Examination council

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## Summary

Ghana is one of the selected counties for the SEIA study. This report is written to get a view of the SMICT education in the non-compulsory 3-years programme of the Ghana Senior Secondary Schools. Promising practices are being selected for the topics Curriculum, Instructional practices, Practical work and ICT. All promising practices can be used as part of the overall results of the SMICT study. Selection should be made using recommendations from the institute and local researchers. Added to the report is a case study of Asankrangwa Secondary School, a rural school where the writer of this report taught for two years.

### Curriculum

The curriculum is based on Blooms philosophy. The new type of syllabi require more skills and variation of teaching methods and resources to set the goals. A good example of the new syllabus is the Integrated science syllabus that has a framework with a separate column for Teaching and Learning activities.

The change in calendar year, the difficulty to get teachers, the use of chalk and talk and the use of English as the instructional language are challenges for the schools that need constant attention.

#### Promising practices

- More emphasis on practical work, excursion and teaching and learning activities in curriculum
- Existence of a practical paper in the final exam
- A modernised curriculum see the Integrated science Syllabus
- The co-operation in WAEC
- Use of a continuous Assessment System
- Various Scholarships
- The set up of a Girls education unit to stimulate the Girl-child

### Instructional practices

A minimum of 27% of the lessons is scheduled for SMICT education. Students studying Agriculture (and some arts students) have 47% of SMICT education. Students with the Science programme have 93% of SMICT education. Traditionally the lessons are teacher-centred and content-driven, but new initiatives try to move teachers to a more participatory teaching method with time spend on comprehension, application and experimentation.

Textbooks are available for the SMICT subjects. These books are recent and relevant and give suggestions for practicals. The coverage of textbooks in schools is 90%. The books are normally lent to the students. Pamphlets are also being used frequently. These pamphlets are not always correct. There is still a gap between the availability and use of books.

#### Promising practices

- GES has awards for the best teachers of the year
- The National Service systems provides teachers to the schools
- Excursions and the use of visual aids are being recommended
- Teacher training colleges emphasise more on visual aids
- Volunteers are working alongside local teachers
- Conferences are organised for teachers
- The Integrated science syllabus has teaching and learning activities for every subject
- Meetings and conferences are organised in the different towns on HIV/AIDS, Girl child education i.e.

### Practical work

The Ministry of Education has set up 110 Science Resource Centre in all the districts in Ghana. These SRC have laboratory facilities with modern facilities. The centres serve as teaching centres and promote practical work. Other schools in the neighbourhood can use the facilities by using of the SRC bus.

The SRC has a lab-assistant; a co-ordinator and a budget to renew and buy wanted materials. Manuals to do practical work are available as well as computers.

### **Promising practices**

- The existence of Science Resource Centres with a lab assistant
- Manuals with suggestions for practicals are available in the Resource Centres
- The final exam has a practical paper, encouraging teachers to do more practical work
- The STME-clinic organises practicals for (JSS) girls
- The Science Resource Centres have 6 computers with a lot of educational software
- 40% of the Continuous Assessment System in science need to be addressed to practical work
- Schools are advised to do excursions and have farms for the subject Integrated science

### **ICT**

ICT is getting important in Ghana. ICT is still not a separate subject, but it is incorporated in the Integrated Science syllabus. The use of computers has been facilitated in SRC's by the 6 computers available with educational software.

Internet is not available in most schools as well as reliable electricity supply. The availability of computer literate teachers is also very low. The students to teacher/ ratio in specific schools in the worLD project is also quite high: 78. More attention need to be drawn on these issues.

### **Promising practices**

- Each Science Resource Centre has 6 computers with a lot of hard ware and software
- Teaching schools for ICT have been set up
- Use of a continuous Assessment System
- The government recognises the crucial role of ICT
- Various programmes have been set up as the African Virtual University, Worldlinks and Schoolnet
- WorLD link is an example of a new project that has been active in 14 secondary schools in Ghana

### **Asankrangwa Secondary School, the case study**

Asankrangwa Secondary School can be seen as a typical rural area school. Results and data mentioned in chapter 3 could be used to get a more specific view in the Secondary School issues. The more theoretical information in chapter 2 gets its practical work out in chapter 3.

Promising practices in Asanco that need extra attention are the organisation of excursions, the set up of demonstrations during the Anniversary, the conduction of a Mock examination and the set up of a computer lab with 11 computers. Together with the set up of the lab computer lessons have been introduced and teachers trained. More computers have been introduced in the administration and accountancy office.

**What next?** This report can be seen as a basis for a more detailed report by Ghanaian researchers. JSS data and more detailed data on SMICT education should be collected, as well as data on national policies and teacher training. Promising practices should be developed more and new practices can be added by visiting schools physically

The education policies are dynamic and the government sees education as a high priority. Many initiatives have been developed in the passed decades and still new plans are being made. Due to membership in the WAEC the education in Ghana can be seen as representing more countries than only Ghana. This will give the SMICT study a broader perspective.



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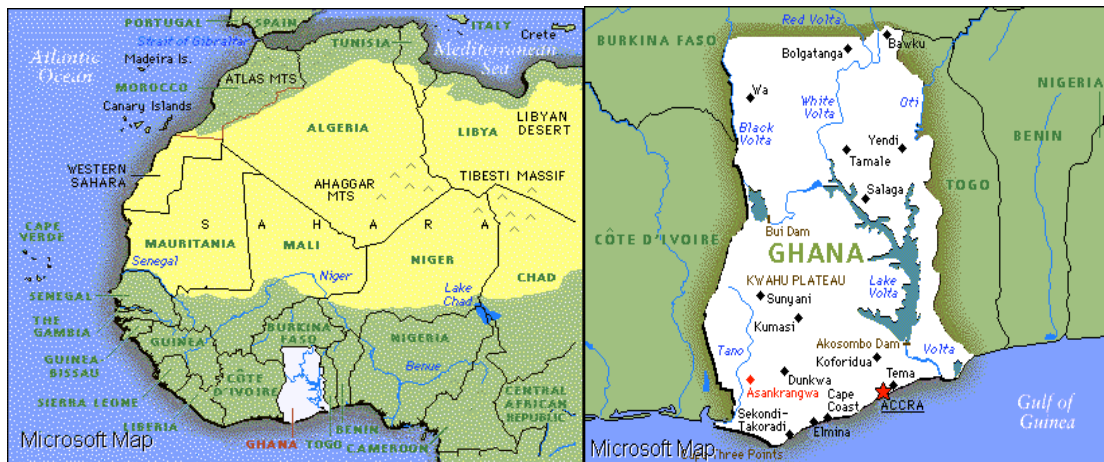
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# 1 Education in Ghana, a general introduction

*This chapter gives a general introduction about Ghana and its education system. The structure of the educational system is ranging from pre-school education to tertiary education will be described. Additionally will be focused on parameters as length of schooldays, class size and student/teacher ratio. Data about SMICT teachers will be mentioned at the end of this chapter.*

## 1.1 Country

Ghana (see figure 1a, b) is an English speaking West-African country bounded by Burkina Faso, Togo and Côte d'Ivoire. It was formerly a British colony and became independent in 1957. For general facts on Ghana see web page <http://www.odci.gov/cia/publications/factbook/>



**Figure 1.a West-Africa**  
(1996, Microsoft Encarta Encyclopedia)

**b. Ghana**

### 1.1.1 Population and principal ethnic group

Ghana has 19.9 million people (2001, PRB). The principal ethnic group are the Akan (44%), followed by Ewe (13%), Ga-Adangbe (8%), Mole-Dagbane, Guan and Gurma (1994, VSO starting pack).

### 1.1.2 Government structure

The country is a Democratic republic under the presidency of Kufuor since December 2001. The president is elected for 4 years. The country is divided into ten local administrative regions.

### 1.1.3 Socio-economic conditions

Well endowed with natural resources, Ghana has twice the per capita output of the poorer countries in West Africa. Even so, Ghana remains heavily dependent on international financial and technical assistance. Gold, timber, and cocoa production are major sources of foreign exchange. The domestic economy continues to revolve around subsistence agriculture, which accounts for 36% of GDP and employs 60% of the work force, mainly small landholders. In 1995-97, Ghana made mixed progress under a three-year structural adjustment program in co-operation with the IMF. On the minus side, public sector wage increases and regional peacekeeping commitments have led to continued inflationary deficit financing, depreciation of the cedi, and rising public discontent with Ghana's austerity measures. Political uncertainty and a depressed cocoa market led to disappointing growth in 2000. A rebound in the cocoa market should push growth over 4% in 2001-02 (CIA, 2002). Some national indicators can be found in table 1.

**Table 1. Some National Indicators**

Indicator	Value	Year	Source
<b>Population</b>			
Population (million)	19.9	2001	PRB
% Population under 15	43	2001	PRB
% Population in urban centres	38	2001	UNDP
Population growth rate	2,6	2000	UNDP
<b>Economy</b>			
HDI	119	1999	UNFPA
GDP/capita (US\$)	360	2000	UNDP
GDP growth rate	4.0	2001	UNDP
Annual inflation rate CPI (%)	23.1	2001	UNDP
Total debt service (% of export of goods and services)	19.3	2000	Worldbank
Gini index (%)	40	1998	Worldbank
Unemployment rate as a proportion of economically active	20	1997	CIA
% Population below poverty line	40	1998	Worldbank
<b>Health</b>			
% Estimated adult HIV infection rate	3.6	2000	UNAIDS
Life expectancy at birth (years)	58	2001	PRB
Total fertility rate females	4.3	2001	PRB
<b>Education</b>			
% Education expenditure as a percentage of GNP	4.2	1996	UNESCO
% Annual government current expenditure on education	24	1996	UNESCO
Illiteracy rate (% age 15+)	29	2000	World bank
% Gross primary enrolment (net enrolment)	79 (no data)	1994	UNESCO
% Gross secondary enrolment (net enrolment)	36 (no data)	1991	UNESCO
% Gross tertiary enrolment (net enrolment)	1.4 (no data)	1990	UNESCO
<b>ICT</b>			
Number of computer per 1000 people	3	2000	ITU
Number of Internet users	30,000	2000	ITU

#### 1.1.4 Importance of education

The total Adult illiteracy rate is 29%, with the illiteracy rates for males being lower (21%) than for females (39%) (1999, UNESCO). Illiteracy rates for people between 15-24 years old are much lower, around 9% in 2000. These illiteracy rates are one of the lowest in West Africa.

The government wants to reduce the poverty and improve the welfare of Ghanaians. An investment in human capital has been identified as one of the highest priorities (2001, Canagarajaa). In 1996 the government spent 24 % of its budget on education. (1999, UNESCO). In 1998 41% of the budget was allocated to Primary schools, 23% to JSS, 15% to SSS, 11% to Universities, 6% to training colleges and 3 % to technical schools. Compared to the expenditure in 1990 the share of basis education declined, in favour of SSS and teacher training budget (Canagarajaa, 2001). For more detailed information about expenditure in basis education see PHRD, 1996. Despite the investments, loans and aids the educational sector still remains seriously under-resourced (VSO, 1999)

To monitor improvements Ghana collects various types of **educational data** from the schools. An every year collection provides a very good source of information to GES en MOE. See appendix 2 for the different educational databases in Ghana. Unfortunately not all data for this report could be found using digital resources on and in Ghana.



## 1.2 Educational system

### 1.2.1 Structure

Before the reform in 1987 the Educational System consisted of 17 years of pre-tertiary education; 6 years Primary Education, four years Middle School, Five years Secondary School (O-level) and two years of Sixth Form (A-level). The new educational system now consists of 12 years of pre-tertiary education: 6 years of Primary school, 3 years of Junior secondary School and 3 years of Senior Secondary School. Most data of this paragraph are obtained from UNESCO 2001 if not cited otherwise.

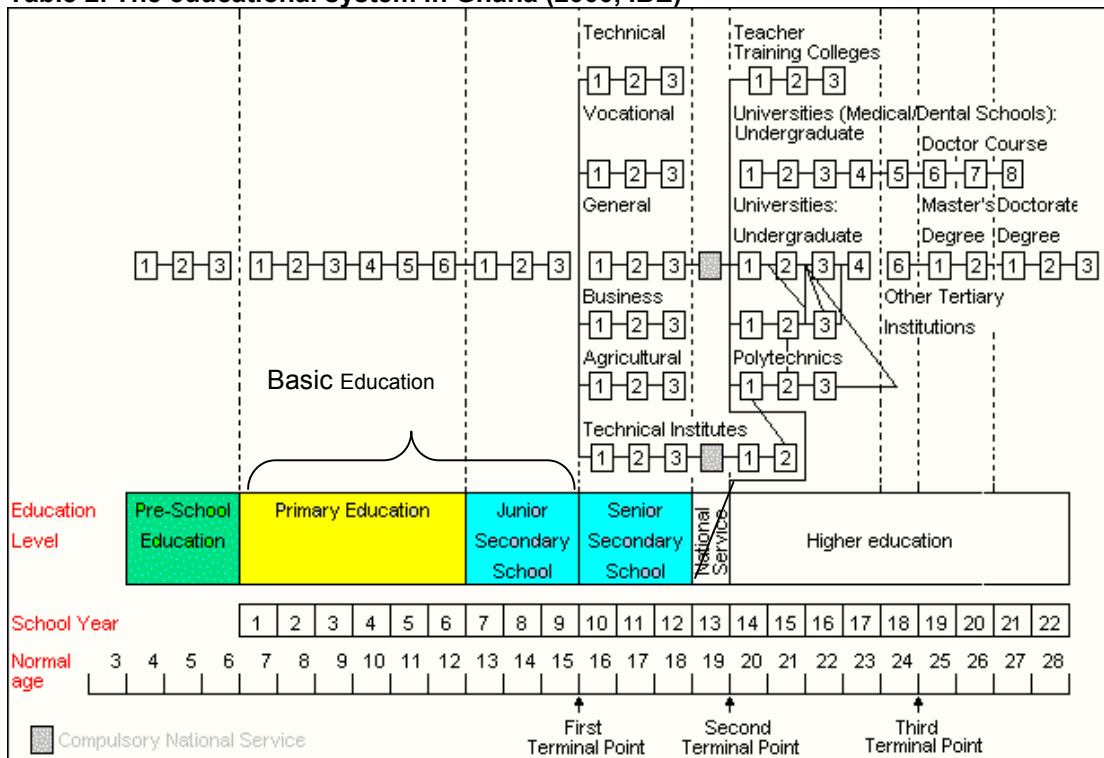
#### Pre-school education

Pre-school education programme (kindergarten) with a programme varying from 1 till 3 years is becoming more popular in Ghana, especially in urban schools. The educational reform programme advise children to have 18-24 months of pre-school education (VSO, 1999). No data are found for this type of education.

#### Basis education

Table 2 shows the structure of the educational system in Ghana including age group, levels of education and school types. The new educational system (since 1987) consists of six years' primary school (compulsory) followed by three years' Junior Secondary School (JSS) and three years' senior secondary education at the end of which pupils sit for the Senior Secondary Certificate Examination (SSCE). The six years of primary education and the three years of junior secondary school form nine years of free compulsory basic education (FCUBE). The current programme of this FCUBE was set in 1995. **The compulsory attendance age** is 6 till 15 years, leading to a minimum leaving age of 15 years. The junior Secondary school ends in a certificate Basic Education Certificate Examination (BECE).

Table 2. The educational system in Ghana (2000, IBE)



## Secondary education

The 3 years Senior Secondary School (SSS) for students from 15 to 18 years are not compulsory. It leads to the certificate Senior Secondary School Certificate Examination (SSCE). Alongside the senior Secondary Schools are Senior Technical schools. These schools have been set up recently to increase the numbers of students in Secondary schools. These schools are mostly day schools. They also have a 3-year programme for the age group 15-18 years that leads to the certificate Senior Secondary School Certificate (SSCE). In theory they should offer more technical subjects with more emphasis on practical skills.

## Higher, tertiary education

The system of higher education includes universities and university colleges; polytechnics; and pre-service training institutes. Polytechnics and teacher training colleges have a 3-year programme. University programmes differ, with a minimum duration of 4 years.

All higher education institutions are under the supervision of the National Council for Tertiary Education, which forms an advisory and co-ordinating body at the national level. The Minister of Education supervises the Council. Each higher institution has its own Council and its Academic Board or their equivalents. The polytechnics are now in the process of being upgraded to offer university-level courses. A new University of Development Studies has been opened in the North and the University College of Education, Winneba, has been established. Teacher training colleges are becoming tertiary institutions. Tertiary education is followed by one year of compulsory national service (IBE, 2000). This national service is not after senior secondary school as mentioned in table 1.

## Public and private systems

Most schools are public schools. In 1996 there were 13,014 primary schools and, 1,249 of them were private schools. In Appendix 1 data for public and private schools are found. The number of private institutions decreases from primary to JSS to SSS. At tertiary school level no private institutions are mentioned. Private schools are also under the supervision of the Ghana Education Service (GES), ensuring conformity to guidelines and regulation in different schools. The personnel for the private schools are also paid by the GES.

## Sources of funding

The central government through the Ghana education system (GES) in the person of the minister of education is the main source of education financing. The contribution of the government is 95% of the expenditure on education. District Assemblies contribute the remaining 5%.

The government pays the salaries for basic and secondary education and provides physical facilities, infrastructure, equipment and furniture for all post-basic education (SSS and tertiary education). It also meets the cost of boarding fees for all students in special education schools (deaf schools, schools in the underdeveloped regions), the allowances in teacher training colleges and the total boarding fees for students in universities and the scholarships for students in tertiary institutions. District Assemblies contribute in the provision of physical facilities, infrastructure and equipment for basic education (primary schools and JSS).

### 1.2.2 School

#### Basic education

The **length of the school year** for basic education is 40 weeks, running from September to August. This leads to **holiday periods** of 12 weeks. The longest holiday is the holiday in July and August. The **length of school day** is 5 hours a day, normally divided in periods of 40 minutes. The length is normally prolonged by compulsory extra classes given in the afternoon or on Saturday. The **average class size** for primary schools in 1993 is 27 for primary and 33 for JSS in 1992 (MOE, 1995). The **pupil/ teacher ratio** is in 1997/1998 35.9 for primary schools and 20 for JSS. This is relatively low comparing other West-African countries having a pupil/teacher ratio of 40 in primary school.



The **enrolment** as General Enrolment Ratio GER is 79% with a **female/male** ratio of 0.92. This is the fourth highest enrolment of West Africa, the gap between females and males is also the second smallest. Gross enrolment rates based on MOE data are slightly different: an enrolment of 72 with a female/male ratio of 0.93. Private school enrolment has remained stable on 13%.

Repetition rates in primary schools in 1992 are 3.2% and 1.2% in Junior Secondary Schools. There is an automatic progression from primary school to JSS. As a result many pupils who are hardly literate and numerate upon completion of the primary school can still enter JSS. In JSS the pass rate in 1994 for the BECE is 84.4 % (MOE, 1995). This BECE is the entry examination to enter SSS.

### Secondary Education

The **Length school year** for SSS is 39 weeks, running from September to August. Because of the shift in the academic year from January to September the 39 weeks have been temporally increased in 1999 to minimise the time lost for students doing exam in the transition period. The **holiday periods** are 13 weeks. The longest holiday is the holiday in July and August. (2000, de Haas). The **length of a school day** has also been temporally increased from eight till nine periods a day in a forty–minutes-lesson. No data were found on the **Average class size**. The **student/ teacher ratio** was 17 in 1997. Officially the schools can have 1 teacher for every 20 students in the school. The **Gross Enrolment Rate** is 36% with a female/male ratio of 0.85. This is the third highest enrolment in West Africa. MOE data of enrolment give an enrolment of 40% with a **female/male** ratio of 84. Private school enrolment has been increased from 1 to 7%. The government decided to contribute more money to the boarding fees starting from 2001 resulting in a higher enrolment and a higher percentage of students entering the boarding houses. The **pass rates** in SSCE examination were 4% in 1994 (VSO, 1997).

### Tertiary Education

The Length school year is variable and depends on the institution. The school year runs from September till June. **The holiday period** is from June till September. The percentage of female students in universities is 22%. The **length of school day, average class size, student teacher ratio** and **pass rates** are variable and more data should be collected to find out the statistics about this. The **enrolments** as GER is 1.4%, with a female/male ratio of 0,30 (1995, GCS). The enrolment is one of the lowest in West Africa.

#### 1.2.3 SMICT teacher in Senior Secondary Schools

Students choose the job teacher for job security and social mobility. A career in teaching is by some students considered as a gateway to further education and a better job. (Akyeampong, in press, 2002). A teacher's salary is relatively low and most teachers would like to move to another job if available. (VSO, 1997) The job of a teacher is seen as an important, but low **status job** (King, 2002). SMICT teachers and especially ICT teachers have a higher chance to get another job and move out of the schools.

Most teachers enter training colleges with low grades. 9% of the teachers do not have a pass in science (Coultras, in press 2002). For secondary schools no data were found about the percentage of **experienced** trained and untrained teachers, but it is assumed that data from Junior Secondary Schools will be quite similar: in 1996 87% was trained and 13 % untrained (Acheampong, 1999). No data were found about the **average age** of the teachers.

In total in SSS in 1991 39% of the students is female so the **gender split** of the **students** is not so high. The **gender split** of **teachers** is much higher. In the general Core subjects Mathematics, Integrated Science, English, Social studies, Physical education and Religious and Moral education the percentage female in 1991 is 24%. The percentage of female SMICT teachers (Elective Mathematics, Biology, Physics and Chemistry) is much lower.



## 2 SMICT education on Senior Secondary Schools

*The coming chapter informs about the SMICT education in Senior Secondary Schools in Ghana and the general aspects of the SSS programme. After this the areas curriculum, instructional practices, practical work and ICT education will be treated. Information will be given about major changes, current important issues and promising practices in each of these areas. Most data of this paragraph are obtained from de Haas, 2000 if not cited otherwise.*

### 2.1 General

A student studying the three-year SSS can choose between 6 programmes: Agriculture, Business (Accounting & Secretarial), General (science & Arts), Vocational (Home Economics & visual Arts) and Technical. All students studying in SSS have 4 examinable Core subjects and two internally examinable subjects. Depending on the programme students also study three or four Elective Subjects. In table 3, 4 and 5 you can find the different subjects that a student studies. Most schools offer between two and four of these programmes. The elective subjects have 7 periods of 40 minutes a week and the core subjects vary.

A Science in the programme Science, for example, studies the General Science Program. This student gets the compulsory **core subjects** English, Mathematics, Integrated Science, Social studies, Physical education and Religious/Moral education. For his **electives** Elective maths is compulsory. His other 2 or 3 elective subjects will be chosen out of the list for example Biology, Physics and Chemistry.

**Integrated science** is a compulsory subject. Every student will attend these lessons. Integrated science is a combination of Physics, Chemistry, Biology, Agriculture and Environmental science. Technology is also incorporated in the subject. Ideally one teacher will teach this subject according of the integrated science syllabus. In practice not all teachers find themselves confident to teach all different parts of the syllabus. The subject then will be split into parts and the teacher will only teach his/her speciality. New Integrated science teachers will come off the Teacher Training Colleges and will be able to teach the whole subject.

In 1987 the new educational System turned the Middle School into JSS and the new 3-year SSS started off. In 1991 the first SSS started. Because the increase in numbers of students going to SSS many new school were opened (in total more than 450 SSS now). These new schools were mainly day schools opposed to the 258 pre-reforms established school that were mainly boarding schools. The SSS is not compulsory. Students can enter SSS if they pass the JSS examinations.

The SSS fall under the GES. In figure 2 you see a diagram of the organisational structure in SSS.

#### Table 3. Core subjects in SSS:

##### External exam:

- English Language
- Mathematics
- Integrated science (combination Physics, Chemistry, Biology and Agricultural & Environmental Science)
- Social studies (combination Economics, Geography, History, Government)

##### Internal school exam:

- Physical Education
- Religious and Moral Education



**Table 4. Elective subjects of the Agriculture, General and Technical Programme**  
(de Haas, 2000)

Agriculture	General		Technical
	Arts	Science	
1. General Agriculture	Three or four out of:	1. Maths elective	1. Technical Drawing
2. Two or Three out of: a <sub>1</sub> ) Crop husbandry & Horticulture a <sub>2</sub> ) <b>Animal husbandry</b> a <sub>3</sub> ) Fisheries a <sub>4</sub> ) Forestry	a) Literature in English	2. Two or Three out of: a) Physics b) Chemistry c) Biology d) Technical Drawing e) Geography	2. One out of a) Applied Electricity b) Electronics c) Auto Mechanics d) Building & Construction e) Metalwork f) Woodwork
	b) French		
b) Chemistry	c) Music d <sub>1</sub> ) Christian Religious Studies d <sub>2</sub> ) Islamic Religious Studies d <sub>3</sub> ) Traditional Religious Studies	3 <sub>a</sub> ) French 3 <sub>b</sub> ) Music	3. One or Two out of: a) Physics b) Mathematics elective c) French
c) Physics	e) Economics		
d) Mathematics elective	f) Geography		
e <sub>1</sub> ) French e <sub>2</sub> ) Music	g) History h) Government i) Mathematics elective j) General Knowledge in Art		

**Table 5. Elective subjects of the Business and Vocational Programme** (de Haas, 2000)

Business		Vocational	
<i>Accounting</i>	<i>Secretarial</i>	<i>Visual Arts</i>	<i>Home Economics</i>