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Journal of

EDUCATIONAL MANAGEMENT

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EDITORIAL COMMENT

JEM is a new academic Journal. Some delays in coming up with this second issue of JEM are due to the fact that time was required to create a market and stimulate demand for the new journal. Our first edition is now being received with the expected embrace. No doubt the journal has come to stay. We will soon be able to regularize the bi-annual publication of the Journal.

In this second issue Opare got the ball rolling by reporting the study in which he compared the academic performance of pupils in public and private Junior Secondary Schools in Ghana. The superior performance of pupils in private schools is attributable, in part, to the fact that private schools are better equipped, better managed and more supported by parents. Ghana is committed to improving conditions in the basic education sub-sector. Owolabi's study establishes some demographic characteristics in education pertaining to the issues of **access, gender balance, teacher supply** and **level transition**. The findings can provide the substructure on which to base yearly evaluation of progress made in those areas.

Three research reports are on the management of teaching related problems. They should be of special interest to teachers and supervisors of pre-tertiary schools. Koomson, Akyeampong and Fobih find that due to teachers' lateness to class, absence from school and teaching only a few subjects on the time table, 50% of instructional time is mismanaged in Ghanaian primary schools. Ossei-Anto analyzes problems affecting science teaching in pre-tertiary institutions due to the inadequate supply of science equipment and materials. Included in his suggested possible solutions are provision of Science Improvisation Centres (SICs) and science museums. Secondary school students in Ghana irrespective of age, sex, class or programme of study believe that force implies motion and motion implies force, and friction is force which always opposes motion. Otuka, Anamuah Mensah and Thompson found this out in their study and draw implications for instructional management. On education system management Olorundare discusses the merits and demerits of nation-wide examination and ponders on whether it is a blessing or a diploma disease. He cautions against complete dependence on country-wide examinations. Japan, a country in the fore front of industrial growth, is adopting some unique management techniques which are basically "people-oriented". To achieve "productivity through people" , Pericles is proposing that educational managers should adopt plausible aspects of Japanese management techniques in their work settings. Owing to the sapping

effects of SAP on social service programmes there has been serious gaps between vision and action in the provision of primary education. To ameliorate the wrenching effects of adjustment Babalola and Sikwibele are suggesting some strategies for planning primary education. Useful lessons can be drawn from their suggestions for Nigeria.

Owusu's paper is on institutional management. He discusses some aspects of management functions that should receive the attention of newly appointed heads at the University of Cape Coast. The last paper by Fabunmi offers a general overview of strategic Management of Science, Technology and Mathematics education in the developing world and provides recommendations for improving this form of education.

JEM now accepts **Brief Reports** of tried-out management tactics and **Comments** from principals, headmasters, supervisors and other system managers. This is to promote cross fertilization of experiences in educational management. The first two of such brief reports and comments are from Amuzu Kpeglo and Christie Okae-Anti. Middle level manpower development is known to be the understructure for any "industrial take off" and polytechnic education provides the technical know-how. Amuzu Kpeglo reviews the enticing career opportunities of the HND programme of the Ho polytechnic and concludes that the sky is the "limit" for these people to grow. Okae-Anti ponders on the novel idea of the PRO participating in university decision-making.

You are invited to join JEM readers world-wide in reading and reflecting on some problems of educational management in contemporary societies, and if any article provokes your comments please write to the editor.

S. O. Owolabi
Editor

Dr. A. L. Sikwibele is a Senior Lecturer and Acting Head of Department of Educational Administration, University of Zambia.

Dr. J. B. Babalola is a Senior Lecturer in the Department of Educational Management, University of Ibadan.

Dr. J. S. K. Owusu is a Senior Lecturer in the Institute for Educational Planning and Administration, University of Cape Coast.

Dr. Fabunmi is a lecturer at the Department of Educational Management, University of Ibadan.

Dr. A. Amuzu-Kpeglo is a Senior Lecturer in the Institute for Educational Planning and Administration, University of Cape Coast.

Mrs C. Okae-Anti is a former Assistant Registrar in the Public Relations Office, University of Cape Coast.

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ACADEMIC ACHIEVEMENT IN PRIVATE AND PUBLIC SCHOOLS : MANAGEMENT MAKES THE DIFFERENCE

J. A. Opare

ABSTRACT

This paper presents a report on a survey done to compare the academic performance of pupils in public and private junior secondary schools in Ghana. Data for the study were collected from a random sample of 800 pupils, 60 teachers, and 20 headteachers selected from 20 schools in the Accra and Sekondi-Takoradi Metropolitan areas. The results indicate that pupils in the private schools did far better than those in the public schools. The difference is attributed to the fact that the pupils in the private schools come predominantly from middle-class homes where parents set high academic standards for their children. The more important explanation is that the private schools are better equipped, better managed, and more supported by parents.

Introduction

Education is today recognised the world over as the single most important social institution that influences and is influenced by other social institutions. It is recognised that the social, economic, political, and cultural development of nations depends largely on the quality and amounts of education their citizens have. The rise of Japan into the status of an economic giant today (Evans, 1991), as well as the emergence of Hong-kong, Singapore, Korea, Taiwan, and recently Malaysia, into economic miracles, have all been attributed to the heavy investments these countries made in the education of their citizens (Ranis, 1990). It is because of the strong faith in education as an engine of development that nations today invest so much in that social institution.

On the attainment of independence Ghana, like many other African and developing nations, embarked on an educational expansion programme. The Accelerated Development Plan for Education of 1951, and the Education Act of 1961 were both meant to increase access to education (Graham, 1976). The same object guided the New Educational Reforms of 1987. With

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the exception of the Reforms of 1987, however virtually none of the previous educational programmes gave any serious attention to the question of education quality and pupils' academic achievements. Consequently, there is the complaint that academic standards have fallen, or are falling (Mensah, 1995). The greatest disappointment is caused by the observation that pupils'

academic performance in private schools is far higher than what prevails in the public schools, where the bulk of pupils receive education (Mensah, 1995).

The following statistics published by the Ministry of Education seems to underscore the allegations made by the concerned public.

Table 1
Criterion Reference Test Results for Private and Public
Schools in Ghana : 1994, 1996, 1997

Year	Type of School	Subject	Mean Score	Percentage reaching mastery level
1994	Public	English	31.0	3.3
		Maths	27.7	1.5
	Private	English	58.8	51.4
		Maths	47.3	31.7
1996	Public	English	33.0	5.5
		Maths	28.8	1.8
	Private	English	61.0	56.5
		Maths	47.0	31.0
1997	Public	English	33.9	6.2
		Maths	29.9	2.7
	Private	English	67.4	68.7
		Maths	51.7	40.4

Source :   Ghana, Ministry of Education/PREP :
            Criterion Reference Test Reports 1994, 1996, 1997 (1999)

Table 1 clearly shows that even though both school types have been improving steadily in academic performance, the private schools far outdo the public schools. This study went beyond mere comparison of academic performance. The purpose was to account for the differences. The following questions guided the enquiry:

1. Do pupils in private basic schools perform better than their public school counterparts in English and Mathematics?

2. Do pupils in private basic schools come from higher-status homes?

3. Is academic performance associated with socio-economic background ?

4. Are teachers in the two school types similar in terms of professional qualification?

5. Are the two school types equally well equipped ?

6. Are the two school types equally well managed?

Literature Review

Most of the literature explain the increasing popularity of private schooling, as well as why the greatest patronage comes from the elite. The first explanation is that private schools provide the mechanisms for social mobility (Cookson and Persell, 1985) in that they provide environments that are particularly conducive to the academic improvement of even the average student (Powell, Farrar, and Cohen, 1985). The other explanation is that private schooling is perceived as a mechanism for perpetuating the stratification system in that it provides excellent instruction guaranteeing high levels of academic performance (Sernau, 1993). There is paucity of explanation for the high academic performance of pupils in private schools relative to those in public schools in Ghana. The literature, however, provides explanations for academic performance in general. Those factors often cited to explain academic performance and educational attainment are conditions in the home, conditions in the school, and the level of motivation of the student.

With regard to conditions in the home, the socio-economic status of parents, the structure of the family, and sibling size have been cited as widespread factors. The literature suggests that elite parents set high

academic standards for their children at an early age. They also take great pains to draw their children's attention to what socio-economic success is, and the means to that end. Such children naturally tend to take their school work serious, and they invariably become high achievers (Addae Mensah, Djangmah, and Agbenyega, 1973).

Regarding the structure of the family the literature suggests that children in both-parents-present family contexts (intact families) do better on scholastic tests than children in single-parent family contexts do (Astone and Mclanahan 1991; Mulkey, Crain, and Harrington, 1992). The explanation offered is that children in non-intact, especially mother-only, families often suffer educationally because they invariably lack enough emotional and social contact with both parents. Single parents, especially single mothers, may not be able to supervise and monitor their children's school work because they are invariably struggling to make ends meet.

Besides, the low scores at school made by children from non-intact homes, according to Mulkey and herassociates (1992) are attributed to frequent absenteeism. This, they argue, explains why children in single-parent families lower their grades by one-tenth of the grade point average, or one-eighth of the standard deviation when family background is controlled.

Using the resource dilution model, Blake (1989) shows that sibling size is inversely related to academic achievement and educational attainment. Resources such as time, money, attention, space, materials for learning, and so on, are not enough to go around all the children when they are too many relative to the family resources available. Thus, lacking conducive learning environments in the home, and lacking assistance in homework, children with many siblings cannot be expected to do well in school, when family resources are limited.

Many studies on school quality and its effect on learning outcomes indicate that the availability of textbooks is a basic prerequisite for ensuring effective learning (Heyneman and Loxley, 1983, Caillods, 1989; Altbach, 1987). The studies suggest that when textbooks are inadequate or are not available, pupils cannot be expected to do well academically.

In a Ghanaian study, Opare (1981) also found that motivation is a strong determinant of academic

performance. According to him, a student who is determined to excel in school would work hard on his books in order to attain the desired level of performance. The purpose of this study? is to examine the relevance of the factors reviewed thus far for explaining the disparities in the academic performance of pupils in private and public junior secondary schools in Ghana.

Method

The Samples

The samples of schools, pupils, teachers and headteachers involved in this study were selected from the Accra and Sekondi-Takoradi Metropolitan areas. These two metropolitan areas were selected because of the large numbers of private and public schools they have.

Ten junior secondary schools were randomly selected from each of the two metropolitan areas. The ten schools selected from each metropolitan area were made up of five private and five public schools. Four hundred third year pupils were also randomly selected from each metropolitan area. In each of the selected schools a sample of forty pupils (20 boys and 20 girls) was randomly selected. Thus in all, 20 schools and 800 pupils were randomly selected. In addition, the 10 headteachers in all the 10 schools in each of the metropolitan areas were automatically involved in the study. Again, in each school, three teachers were randomly selected for involvement in the study. Thus in all 60 teachers were selected.

Instruments

A five-item questionnaire was designed for the student sample. The questionnaire sought socio-demographic and school-level information that were considered likely to explain academic performance. Another set of questionnaire was designed for teachers. The information sought from this questionnaire included the qualifications of teachers, headteachers' frequency of visits to teachers' classrooms, and teachers' regularity of setting and marking exercises and assignments. Unstructured interviews were held with headteachers to find out about their supervision and monitoring of teachers' work and punctuality. The interviews also sought information on school infrastructure as well as the contribution of Parent-Teacher Associations (PTAs) and School Management Committees (SMCs) to the schools.

Personal observations were used alongside the obstructive methods in collecting data to confirm information provided by respondents. Besides, specially constructed English and Mathematics tests were used to

measure pupils' academic achievements. The tests were based on the syllabuses and textbooks for junior secondary school form two and part of form three. The structure and contents of the tests were based on those of the Basic Education Certificate Examination (BECE) papers.

Analysis and Results

The major task of the study was to seek answers to the research questions. First, the academic performance of pupils in private and public schools had to be compared. To this end the performance of the pupils in English language and Mathematics were compared using the student's T-test. The result of the t-tests indicated that pupils in the private schools outperformed those in the public schools in both English ($t = 10.39$ $p < .01$) and Mathematics ($t = 11.35$, $p < .01$). On the basis of these results it is concluded that pupils in private schools perform better

academically than pupils in public schools.

The second task was to find out if pupils in the private schools come from higher socio-economic backgrounds. Using father's education as proxy for socio-economic background, it was found that 71% of the students in all the schools in general have fathers with secondary education or higher.

The t-test showed, however, that the fathers of pupils in the private schools are better educated than the fathers of pupils in the public schools ($t = 10.45$, $p < .01$). It is therefore concluded that pupils in private schools come from higher-status homes.

The third task was to determine the association between socio-economic background and students' academic performance. Pupils' scores in the English Language and Mathematics tests were cross-tabulated with father's education. The result of that operation is presented in Table 2.

Table 2
Percentage Distribution of Pupils' Mathematics Scores by Father's Education

Scores	Father's Education	
	Low	High
Low	55 (121)	30 (174)
High	45 (99)	70 (406)
Total	100 (220)	100(580)

Note : Absolute numbers are in parentheses.

As indicated in Table 2, pupils whose fathers are highly educated are more represented in the high-scoring group than those whose fathers are not so highly educated (70% as opposed to 30%). There is thus a relationship between socio-economic background and academic performance ($X^2 = 15.3$, df 1, p < .01). There was no statistically significant relationship between socio-economic background and performance in English. The urban background of the pupils may account for the lack of variation between the two types of students. In the urban setting students all the time see and hear people communicate in English. They also have access to newspapers, the television, and radio. All these experiences enhance the English Language learning process.

The fourth task was to find out if teachers in the private and public schools are similar in terms of professional status. Information from the teachers' questionnaires were collated for this purpose. It was found that 30% of the teachers in the public schools had the teacher's certificate 'A' 4-year, while 60% and 10% have the certificate 'A' 3-year post-secondary and the teachers' diploma respectively. On the other hand, 70% of the teachers in the private schools are untrained. Thirty percent are trained. A greater proportion of those trained are retired teachers. The data thus clearly show that teachers in the public schools in the study areas are almost all trained whereas only a small proportion of those in the private schools are trained.

The fifth task was to determine if the private schools and public schools are equally well equipped. Data collected through personal observation and the unstructured interviews with headteachers were used to this end. It was observed that the private schools have more and better furniture for both pupils and teachers. They also have sufficient textbooks and stationery. Most of the pupils also have their own textbooks. The private schools also have better stocked libraries and other teaching-learning materials. Some of them even have computers and computer laboratories. Few of the public schools are so well equipped. In some of the public schools a lot of congestion was observed. The congestion was due to limited space and inadequacy of furniture. From these observations one can rightly conclude that the private schools are better equipped than the public schools.

The last task was to find out if the private schools and public schools are equally well managed and

supported. Personal observation, coupled with data from the teachers and headteachers yielded the information for this task. It was observed that monitoring and supervision of the teacher's work are a constant practice in the private schools. The headteachers insist that lesson plans are up-to-date. They also check on punctuality, regularity, and use of instructional hours. This rigid enforcement of the rules and principles were found to be either non-existent or inadequate in most of the public schools studied.

Differences in the climates prevailing in the two school types were also observed. Activities in the private schools were found to be goal-oriented. The teachers' task was to ensure that the students master learning tasks and do well in examinations. Decision making was virtually left in the hands of the proprietors and their administrators. Those conditions found prevailing in the private schools were not found in the public schools, where the teachers were found to perform their tasks at their own pace and convenience. Teachers in the public schools, however, were found to be actively involved in the day-to-day decision making and running of the school.

Disparities in the motivation of teachers were also found between the private schools and the public

schools. Whereas teachers in the private schools receive some incentives from the school authorities and some parents from time to time, those in the public schools receive virtually none. Parents with pupils in the public schools even hardly visit the schools, much less give the teachers incentives. The PTAs and SMCs of the private schools were also found to be very supportive of the efforts of the schools. On the basis of these observations one can say that the private schools are better managed than the public schools.

The type of family context in which pupils were embedded was also examined. This involved an examination of the number of siblings each pupil had, and whether they were in intact families or non-intact families. About 63% of the pupils in both school types were found to have an average of four siblings. However, when this was examined more closely it was observed that more of the pupils in the private schools have fewer siblings (an average of 2) than pupils in the public schools. This means that sibling size and type of school a pupil is likely to attend are related ($X_2 = 8.31$, df 1, $P < .01$), and that the smaller the sibling size the more likely it is that a child will be put in a private school. About 62% of the pupils in the private schools, and 31% of those in the public

schools were found to come from intact (both-parents-present) homes. Going by Astone and Mclanahan's studies, one would say that pupils in the private schools live in more educationally conducive home environments.

Discussion

This study was designed to find out if in reality pupils in private schools are academically better than those in public schools. It was also designed to explain the disparities in academic performance between the two school types, if there are disparities at all. The results of the study confirm that pupils in private schools actually outperform their public school counterparts in academic work.

The results show further that most of the pupils in the private schools come from middle class homes. A relationship between socio-economic background and academic performance has also been found.

We can rightly infer from the above that pupils in the private schools are academically better than their public school counterparts because of the middle class backgrounds of the former. It must be argued from the point of view of matching theory that middle class parents are more conscious of the benefits of education. They also know better

what socio-economic success means, and the means to that end. Such parents tend to communicate this knowledge to their school-going children and wards, who in turn, get inspired to work hard and do well in school. The social support middle class parents offer to their children thus explains the high academic achievement of pupils in private schools relative to those in public schools.

Besides the social support that middle class parents offer to their children and wards, there is also the fact that such parents also put pressure on their children to study hard. They also monitor their progress in school, making their children feel a sense of mattering. Such a sense of mattering invariably tends to serve as a motivator to pupils to learn hard.

The finding that pupils in the private schools in general come from intact homes, and that they have fewer siblings are quite insightful. When we consider these facts against the background that most of them come from middle-class backgrounds, we can rightly infer that middle-class parents understand the dilution effect of having many children. Since middle-class parents have fewer children, they are more able to distribute their resources more evenly over their children. It is natural, therefore, that children of

middle-class parents, who happen to be over represented in the private schools, are better academic achievers than their public school counterparts because they have a wider range of parental resources to draw on.

Furthermore, since more of the pupils in the private schools have both parents co-present, it is natural that parental monitoring and supervision of such children's school work would be effective. This also might account for the high academic performance of pupils in private schools, relative to that of those in public schools.

The most important finding from this study is that the private schools, as compared to the public schools, are better equipped. They are also better managed. Thus, if, in spite of the relative under-qualification of their teachers private schools outperform the public schools in academic work, then we can attribute that phenomenon to the better equipment and management of the private schools. The lesson we can gather from this idea is that the schools must be run as profit-oriented business units with clearly defined goals and modes of operation. For example, the public schools, taking their cue from their private counterparts, must have pupils' academic achievement as their prime goal. The monitoring and supervision of teachers' work must be effectively done. Teachers'

punctuality and regularity, the way they conduct their lessons as well as their setting and marking of exercises and assignments - in fact their use of instructional time - must be closely monitored, but not policed.

All the above call for the appointment of effective headteachers for the schools in the public system. This cannot be possible, however, unless the position of the headteacher is made substantive. It means that the selection or appointment of headteachers for the nation's schools should not be based merely and only on length of service or academic qualification. The person's managerial and entrepreneurial competence must be important criteria for making individuals heads of public schools. What this translates into is that the position of the headteacher of a public school should no longer devolve on a person: it must be competed for, and the one with the greatest promise of achieving results must be selected.

This writer is of the conviction that it is time the Ghana Education Service took bold steps to deviate from the practice of carrying the headteacher's job to the longest-serving teacher with little consideration for initiative, drive, resourcefulness, and managerial acumen.

Conclusion

Academic success is a good measure of pupils' mastery of know-how and know-what. Hence the academic achievements of pupils are of great concern not only to parents, but also to the public at large. That is why the relative under-achievement of public schools has generated such a serious public outcry.

The relative academic success of private schools is due largely to their better management. This suggests that the public schools too must focus on the managerial competence of the prospective headteacher, for it is only when the headteacher has managerial acumen that he or she can harness resources in the school and the community to promote pupils' learning. In order that the public school headteacher can have the legitimated power to do this, the position must be selective rather than appointive. Otherwise pupils in the public schools would always receive the warning that "Abandon all hope, all ye who enter here."

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ANALYSIS OF TRENDS IN GHANA'S
SCHOOL-GOING POPULATION

S. O. Owolabi

ABSTRACT

The structure of a population is of special interest to the educational planner who must be able to assess the relative size of school-age population. Analysis of trends in the school-going population is also necessary in planning for school facilities expansion.

*Because the government of Ghana is committed to improving conditions in the basic education sector this study is set forth to establish some demographic characteristics in education pertaining to the issues of **access**, **gender bias**, **level transition** and **teacher supply**. The findings of the study can be used as a reliable substructure on which to base yearly evaluation of progress made.*

Introduction

A good programme plan in the social service sector relies heavily not only on the structure of *the population at need* (Rossi, et al, 1979) at any point in time but also on trends in the movements of such populations over time. Population, in this paper refers to a well-defined group of human beings inhabiting a geographical area, such as a city, a district, a region, a country, a continent. etc. The term

may also be applied to sub-groups of human beings in those areas, such as all men above the age of 21, women of child-bearing ages, school-age children, etc. Interest in this paper is on the school-going population of Ghana on the eve of the Free and Compulsory Universal Basic Education programme. The crudest error an educational planner can make is to ignore, in whole or in part, the effects of demographic changes on plans for education (Chau, 1969).

On one hand, educational planners have to show interest in the composition or structure of the client systems at particular points in time. They have to know how clients are distributed by age, sex and occupation. A study of the actual current situations of human groups of interest is commonly referred to as *static* population study (Chau, 1969). Distribution by age and by sectors of economic activity, as well as the geographical distribution of populations are of special interest to designers of educational programmes for three reasons :

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In the first place, planners of basic educational programmes must be able to assess the relative size of the school-age population (population age groups that could be in school) in order to identify target populations for various educational programmes of basic education and make adequate plans for the number expected in schools. The size of the school-age population provides the basis of planning for educational facilities expansion. It also provides the yardstick against which we can measure the extent of programme coverage at later dates.

Secondly, a fair estimation of manpower requirement for an economy is dependent on an accurate knowledge of the distribution of population according to sectors of economic activity and according to occupational types. Hence, educational planners need to know about occupational distribution of populations to determine target for technical and vocational education and to know how many to enrol for professional programmes (Owolabi, et al, 1991).

Thirdly, a study of the geographical distribution of populations is a *sine qua non* for planning the location of new schools and for expanding existing ones (Barclay, 1958; Chau, 1969; Hallak, 1977, Patwari, 1981; Owolabi, 1984).

On the other nand, interest in the study of population can be centred on trends in population or movement of populations. This is the *dynamic* aspect of population analysis. Population trend, which is dependent on such demographic events as marriages, births, deaths and migrations, have serious impact on educational planning. This is because the sizes of populations (and by implication, the sizes of target population for various programmes of education) keep changing over time, as a consequence of the combined effect of natality, mortality and migrations.

In the developing world ability to analyze trends in school-going populations is essential for the managers of the fast expanding educational systems who have to provide facilities and ensure regular inflow of adequate resources for education. Analyzing demographic data involves making a statistical description of population groups and seeking the causes behind demographic facts that may be revealed. Analysis of trends in school-going populations is the bedrock on which educational plans are laid. The people on whose shoulders rests the responsibility of providing schools and teaching resources for the school-age populations must therefore be equipped with a repertoire of techniques for describing the static

state of a population and analyzing statistical data on population movements.

Objectives of Study

This is a study of trends in school-going populations at the basic level of education in Ghana. The government of Ghana recognizes basic education as the fundamental building blocks of a nation (MOE, 1996). It regards a participatory, literate citizenry as the foundation of economic growth, political stability and social well-being of a country. In recognition of this, the government is embarking on a bold plan to extend access to basic education to cater for all school-age children in Ghana by the year 2005, the goal being to ensure that all young people of today are adequately equipped with the fundamental knowlege and skills as well as the right attitudes that will enable them to participate actively in national development.It is also observed that the enrolment of girls is invariably lower than that of boys at all grades and levels of education in Ghana. The government desires to reduce gender differentials in Primary 6 completion and J.S.S.1 entry by 50 % by the year 2005 compared with the present level, (MOE, 1996a).

Finally, the quality of teaching and learning is observed to be very low. Evidence from recent assessments indicate that increased funding of education at the basic level has not contributed in any way to improvement in the literacy and congnitive abilities of pupils (MOE, 1996a).

The quality of the present basic education in many schools is insufficient to impart sustainable literacy and knowledge, skills and habits required for full social and economic participation in society. As part of the intervention design to improve quality of teaching and learning, new teachers will be trained and old teachers will also receive in-service training in a re-structured system of teacher training.

It is expected that progress towards the achievement of the above stated goals will be evaluated on a yearly basis. This paper is set forth to establish trends in school-going population of Ghana at the basic level on the eve of the FCUBE programme. It is expected to set up the substructure on which to base yearly evaluation of progress. The study therefore has the objectives of setting up baseline data on *access to basic education*, admission and *level transition*, *gender balance* in primary and junior secondary schools and *teacher supply* at the two levels of education. Towards this end a cursory assessment of trends of pupil enrolments and teachers on roll at

the two levels is necessary. Analyses of growth rates, gross admission rates, gross enrolment rates, girls participation rates, and pupil / teacher ratio also need to be carried out.

To achieve the objectives of the study, the following research questions were raised :

On access to basic education

1. What were the trends in pupil enrolments at the primary and junior secondary schools in Ghana between 1988 and 1995 ?

    a. What were the growth rates of enrolment at the two levels during the period ?

    b   What were the Gross Enrolment Rates at the primary and junior secondary schools in Ghana between 1988 and 1995 ?

    c   What were the Gross Admission Rates at the two levels of education during the s t u d y period ?

On gender balance

2. What were the participation rates of girls at the two levels of education during the period of study ?

On transition rates

3. What were the level transition rates of pupils from the primary level to the junior secondary level of education during the period ?

    a   What were the level transition rates of girls during the period ?

    b   What were the level transition rates of boys during the same period ?

    c   Were there any differentials in the flow rates of boys and girls into J.S.S. 1 during the study period ?

On teacher supply.

4. What were the trends in teacher supply at the Basic Education Levels in Ghana between 1988 and 1995 ?

    a   What proportions of the teaching staff were trained ?

    b   What were the pupil / teacher ratios at the two levels over the same years ?

Method

Data were gathered from the records of the statistical division of the Ministry

of Education, Accra. These data were compiled from the returns of headteachers all over the country at the time of the study.

Data were also extracted from the Overview of the FCUBE Programme (a policy document of the Basic Education Sector Improvement Programme BESIP/ GH, 1996). To be able to make analysis of trends, the relevant data for the last seven years were extracted from various Ministry records, collated and processed by manual computation, making use of rates and ratios as well as simple percentages. In a work like this, more refined measures such as age-sex-level-specific enrolment rates would be ideal, but data for such measures are hard to come by. Pupils are distributed by grade and not by age. Children of different ages are therefore found in each grade. There is no age-grade-system of schooling in this part of the world. The author therefore has to make do with gross rates. The limitation posed by this type of data gathered notwithstanding, it is still possible to study trends in the gross rate and plan for improvements. The findings were tabulated and discussed. Based on the results, suggestions were made on how to facilitate the achievement of goals in the FCUBE programme relating to trends in the school-going populations at the basic level.

Analysis of Data

There are four main areas of concern in this trend analysis. In each of the four areas one is interested in knowing what the trend has been and what the situation is at present. The four areas are : *access* to basic education, *gender differentials* at the basic level, level transition rates by gender and *teacher supply* at both levels of education. These four areas are well covered by the research questions. The treatment of data are therefore based on the research questions.

Question 1. What were the trends in pupil enrolments at the primary and junior secondary schools in Ghana between 1988 and 1995?

As can be expected under normal circumstances in a country with expanding population, there was a rising enrolment at the two levels over the years. Primary school enrolments expanded from about 1.7 million in 1988 to about 2.2 million in 1994, while the junior secondary school enrolments grew from about 608,690 in 1988 to about 714,544 in 1994. The growth rates ranged from 1.7% to 7.8% at the primary level and from-8.9% to 6.5% at the J.S.S. level. There were drops in the enrolment figures at the J.S.S. level in the years1988 and 1990 which introduced negative growth rates (Table 1).

Table 1
Trends in Enrolments at the Basic Education levels Ghana 1988 - 1995

Year	Primary Level		J.S.S. Level	
	Enrolment	Growth Rate (%)	Enrolment	Growth Rate (%)
1988/89	1694350	1.7	608690	-0.2
1989/90	1805258	6.5	625018	2.7
1990/91	1945422	7.8	569343	-8.9
1991/92	2011602	3.4	605760	6.4
1992/93	2047293	1.8	644976	6.5
1993/94	2112692	3.2	678797	5.2
1994/95	2180251	3.2	714544	5.3

Sources :
Culled from :   1)   Ministry of Education, , (1996a) *Basic
                            Education Sector Improvement Programme/
                            Policy Documentation/GH* Accra : Author

                   2)   Ministry of Education, (1996b) *Records of the
                            Statistical Division,* Accra : Author

Table 2 :
*Gross Enrolment Rates (GER) of the Basic Education Levels, Ghana, 1988 -
1995.*

Year	Primary Level			J.S.S. Level		
	Population 6 -11 Years of age	Enrol.	Gross Enrol. Rate (%)	Population 6-11 Years of age	Enrol.	Gross Enrol. Rate %
1988/89	2,273,276	1,694,350	74.5	980.187	608,690	62.1
1989/90	2,383,611	1,805,258	75.7	1,012,238	625,018	61.7
1990/91	2,453,948	1,945,422	9.3	1,044,289	569,343	54.5
1991/92	2,544,281	2,011,602	79.1	1,076,340	605,760	56.3
1992/93	2,638,830	2,045,293	77.6	1,108,666	644,976	58.2
1993/94	2,738,517	2,112,692	77.1	1,140,635	678,797	59.5
1994/95	2,836,772	2,180,251	76.9	1,177,493	714,544	60.7

Source :

Culled from : Ministry of Education, (1996a). *Basic Education Sector Improve-
                ment Programme/Policy Document/GH.* Accra : Author.

Table 2 presents the Gross Enorlment Rates (GER) at both levels. The Gross Enrolment Rates rose from 74.5% in 1988 to 79.3% in 1990. Then it started to fall steadily, until it dropped to 76.9 in 1994. The actual enrolments became higher every year. But from 1991, the expansion in enrolments were not commensurate with the expansion of primary school-age population. At the J.S.S. level, GER were high up to 1989 (62.1% and 61.7%) as were the actual enrolments. It came down to 54.5% in 1990 and rose steadily to 60.7% in 1994.

Queation 2. What were the participation rates of girls at the two levels of education during the period of study?

Table 4 presents an encouraging trend. There were gender differentials in school enrolments at the two levels of education alright. More boys than girls were enroled at each level. But girls enrolments increased more rapidly over the years. For every 100 girls enroled at the primary level about 125 boys were enroled in 1988. The differentials in enrolment steadily declined to about 117 boys for every

Table 3 :
Gross Admission Rates (GAR) at the Basic Education Levels, Ghana. 1988 - 1995

Year	Primary Level			J.S.S. Level		
	6-Year-old	Enrolment	Gross Admission Rate(%)	12-Year-old	Enrolment	Gross Admission Rates(%)
1988/89	414,099	374,612	90.5	340,881	193,079	56.6
1989/90	432,089	389,147	90.1	351,338	200,541	57.1
1990/91	450,079	420,772	93.5	361,795	218,455	60.4
1991/92	468,069	415,255	88.7	372,252	232,387	62.4
1992/93	498,688	416,184	85.5	383,363	242,848	63.3
1993/94	5.5,885	422,635	83.5	395,471	251,533	63.6
1994/95	526,263	429,188	81.6	405,885	260,757	64.2

Source:
Culled from :*Ministry of Education, (1996a).* BESIP/Policy Document/GH.
Accra, : Author

Table 3 shows that the admission rates in primary schools declined over the years from 93.5% in 1990 to 81.6% in 1994. Conversely, it rose steadily from 56.6% in 1988 to 64.2% in 1994 at the junior secondary level.

100 girls in 1994. At the J.S.S. level 142 boys were enroled for every 100 girls in 1988 and 1989. Girls participation rates slacked down in 1990 and then started to pick up again.

Table 4
Sex Ratios at the Basic Education Levels. Ghana. 1988 - 1995

| Year | Primary Level | | | J.S.S. Level | | |
	Female	Male	Male Per Female	Female	Male	Male Per Female
1988/89	711182	887261	124.8	251446	357244	142.1
1989/90	764064	939010	122.9	258188	366830	142.0
1990/91	879430	1065992	121.2	232135	337108	145.2
1991/92	918411	1093191	119.0	249571	356189	142.7
1992/93	940508	1106785	117.7	270846	374130	138.1
1993/94	985935	1152700	116.9	286458	389724	136.1
1994/95	998860	1155786	115.7	297392	393166	132.2

Source :
Culled from : (1) Ministry of Education, (1996b). *Records of the statistical Division,* Accra : Authors

(2) Ministry of Education, (1994). *Ghana National Forum on Basic Education,* Accra : Authors

By 1994 there were just 132 boys for every 100 girls. The gap was steadily closing up over the years.

Question 3 . What were the level transition rates of pupils from the primary level to the junior secondary level of education during the period?

The flow rates of pupils from the primary level to the junior secondary level, as presented in Figure 1 were going up and down during the study period. But on the whole, there appeared to be a downward trend. Almost all pupils in primary 6 moved into JSS 1 in 1989 and 1990. But in subsequent years about 9 out of 10 pupils moved from primary 6 to J.S.S. 1.

Figure 2 presents the flow rate of girls from Primary 6 to J.S.S.1. There was a steady decline in the flow rate ranging from 98% in 1989 to 89% in 1994.

Figure 3 shows that the flow rate of boys also declined, but the range between the highest and lowest rates was much higher. The highest rate for boys was 99% in 1990 and the lowest was 88.5% in 1994.

Clearly, there were gender differentials in the flow of pupils from the primary level to the secondary level, as can be seen in Table 5. The flow of females descended from 98% in 1989 to 89% in 1994. That of males were moving up and down between 99% and 88.5%

Figure 1

Flow rates of all pupils from primary 6 into J.S.S. 1, Ghana. 1988-1995

Year	Primary 6 Enrolment	JSS 1 Enrolment	Flow Rate (%)
1988/89	206792	-	-
1989/90	222706	200541	96.98
1990/91	251871	218455	98.09
1991/92	267689	23238	92.26
1992/93	276633	242848	90.72
1993/94	291692	251765	91.01
1994/95	302743	258711	88.69
1995/96	-	-	

Source:

MOE (1996b) Records of the Statistical Division Accra: Author

Figure 2

Flow rates of Girls

Year	Primary 6 Enrolment	JSS 1 Enrolment	Flow Rate (%)
1988/89	86801	-	-
1989/90	94341	85053	97.99
1990/91	108295	91323	96.80
1991/92	115643	98931	93.50
1992/93	120955	105184	90.96
1993/94	128269	109471	90.51
1994/95	134418	114028	88.90
1995/96	-	-	

Source:

MOE (1996b) Records of the Statistical Division Accra: Author

Figure 3
Flow rates of Girls

Year	Primary 6 Enrolment	JSS 1 Enrolment	Flow Rate (%)
1988/89	119991	-	-
1989/90	128365	115488	96.25
1990/91	143576	127123	99.04
1991/92	152046	133456	95.95
1992/93	155678	137664	90.54
1993/94	1634233	142153	91.31
1994/95	168325	144683	88.53
1995/96		-	

Sources:
Culled from : (1) MOE (1996b) Records of the Statistical Division Accra : Author
              (2)   MOE (1994) Ghana National Forum Accra: Author

Table 5
Gender Differentials in the Flow Rates from Primary 6 into
J.S.S. 1. Ghana, 1988-1995.

Year	Total Flow Rate	Girls Flow Rate	Boys Flow Rate	Gender Differentials
1989/90	96.98	97.99	96.25	-1.74
1990/91	98.09	96.80	99.04	+2.24
1991/92	92.26	91.35	92.95	+1.60
1992/93	90.72	90.96	90.54	-0.42
1993/94	91.01	90.51	91.31	+0.80
1994/95	88.69	88.90	88.53	-0.37

Sources :
Culled from : MOE (1966) Records of the Statistical Division Accra: Author
                MOE (1994) Ghana National forum on Basic Education Accra:
              Author

Question 4. What were the trends in teacher supply at the basic Education Levels in Ghana between 1988 and 1997?

Table 6 suggests that teacher supply was irregular over the period of study. Both trained and untrained teachers numbered 62,670 in 1988 and 72,451 in 1991 in the primary school.

In the years 1990 and 1992 the number of trained teachers were a little lower than in the preceeding years. By and large about two-thirds of the teachers in primary schools were trained up to 1993. There was a remarkable upsurge in the number and proportion of trained teachers in 1994 (See Table 6). There were

Table 6:
Trends in Teacher Supply at the Primary Level of Education, Ghana, 1988-1995

Year	Total No Of Teachers	Growth Rate	Trained Teachers	Untrained Teachers	Percentage of Trained Teachers
1988/89	62,670	-	37,769	24,901	60.3
1989/90	62,859	+0.30	41,713	21,146	66.4
1990/91	62,823	-0.06	41,502	21,131	66.1
1991/92	72,451	+15.33	51,310	21,141	70.8
1992/93	67,760	-6,47	46,424	21,336	68.5
1993/94	69,232	+2.17	47,654	21,578	68.8
1994/95	71,863	+3.80	55,325	16,538	77.0

Sources :

Culled from : MOE (1996b) Records of the statistical Division, Accra :Author
            MOE (1994) Ghana National forum on Basic Education, Accra:
            Author

The trend in teacher supply at the Junior Secondary Level was similar. The number rose in a year and fell the following year up to 1993, with 30,708 in 1990 as the mimimum and 37,382 in 1993 as the maximum number (See Table 7).

At the primary level the proportion of trained teachers increased from 60.3% in 1988 to 77.0% in 1994.

about 25,000 trained teachers at the J.S.S. level in 1988. Then the number dropped to 22,874 in 1989. Thereafter, the number steadily rose up to 28,405 in 1994. Trained teachers were more than two-third of the total number of teachers in J.S.S. and sometimes exceeded three quarters of the total. Teaching was more professionalised at the J.S.S level (see Table 7).

Table 7
Trends in Teacher supply at the J.S.S. Level, Ghana, 1988-1995

Year	Total No of Teachers	Growth Rate	Trained Teachers	Untrained Teachers	Trained Teachers as % of Total Teachers
1988/89	34,962	-	24,844	10118	71.06
1989/90	35,262	+0.86	22,874	12388	64.87
1990/91	30,708	-12.90	23,303	7405	75.89
1991/92	34,249	+11.53	24,544	9705	71.66
1992/93	33,824	-1.24	25,473	8351	75.31
1993/94	37,382	+0.52	27,823	9559	74.43
1994/95	37,441	+0.16	+01.16	9036	75.87

Sources :
Culled from : MOE (1996b) Records of the statistical Division, Accra :Author
            MOE (1994) Ghana National forum on Basic Education, Accra:
            Author

Table 8
Pupil - Teacher Ratios at the Primary Level Ghana, 1988-1995

Year	Enrolment	Teachers	Pupil/ Teacher	Trained Teacher	Pupil/Trained Teacher
1988/89	1,694,350	62670	27.04	37769	44.86
1989/90	1,805.258	62859	28.72	41713	43.28
1990/91	1,945,422	62823	30.97	41502	46.88
1991/92	2,011,602	72451	27.77	51310	39.21
1992/93	2,047,293	67760	30.21	46424	44.10
1993/94	2,112,692	69232	30.52	47654	44.33
1994/95	2,180,251	71863	30.34	55325	39.41

Sources:
Culled from: Tables 1 and 9 above

Table 8 illustrates that at the primary level the pupil/teacher ratios were generally lower than 30 for four years (1988/89 to 1991/92) and the ratio hovered around 30 for the remaining years. If we consider trained teachers only the pupil-teacher ratios alternated between 39 and 47. The ratios were much less and more stable at the J.S.S. level. The deviation from 18 was never more than 1. As for pupil/trained teacher ratio, the lowest was 24.40 in 1993 and the highest was 27.32 in 1989. There were 25.1 pupils to a trained teacher on the average. That was not bad at all.

discussion centres around the four main issues of the research. These are issues of *access to basic education, gender bias* in participation, *level transition* and *teacher supply.*

i) *Access to Basic Education*

As in all other developing countries the school-age population in Ghana is expanding every year (Table 2). School enrolments also expanded, from about 1.7 million in 1988 to about 2.2 million in 1994. The Gross Enrolment Rate was 74.5% in 1988 and 76.9% in 1994. The laudable

Table 9
Pupil-Teacher Ratios at the JSS level Ghana 1988

Year	Enrolment	Teachers	Pupil/ Teacher	Trained Teacher	Pupil/Trained Teacher
1988/89	608,690	34962	17.42	24844	24.50
1989/90	625,018	35262	17.73	22874	27.32
1990/91	569,343	30708	18.54	23303	24.43
1991/92	605,760	34249	17.69	4544	24.68
1992/93	644,976	33824	10.07	25473	25.32
1993/94	678,797	37382	18.16	27823	24.40
1994/95	714,544	37441	19.09	28405	25.16

Source :
Culled from: Tables 1 and 7 above.

Discussions

in Ghana, are discussed below. The Planning implications of the population trends at the basic levels of education

efforts of the government to expand enrolment seemed to be undermined by the rapidly expanding base of the population pyramid. This is more noticeable in Table 3 where the new

entrants of 414,099 constituted 90.5% of the primary school-age population in 1988, but the new intakes of 525,263 in 1994 represented only 81.6% of the primary school-age population. The planning implication of the trend is that population figures will keep expanding and school clients will expand at a faster rate. With a crude birth rate of 43 births per thousand population, the six year-olds will grow in number every year. Some of the older children who missed the chance at age six may also be coming back into the system at different points in time unless the age-grade system is instituted by law.

This may lead to an unexpected upsurge in enrolment. An implication of such a situation is that basic educational planners could be caught unawares, especially in the area of resource projections, which have always been the bane of plan implementation. The ministry could, once again, experience the embarrassment of having insufficient resources (classrooms, teachers and materials) to cope with an incidental upsurge in the number expected in Primary 1.

The pattern of access was not much different in JSS. After the first three years, pupil enrolments, GER, and GAR started rising but at a very slow rate. The admission rates of the 12- year-olds of 64.2% in 1994 was still too low for the achievement of set goals.

It is tempting to use level transition rates to plan for junior secondary education. But achieving the objective of junior secondary education is going to be an Herculean task because it will not only require increasing level transition rate to 100% but also eliminating wastages in the form of drop-outs from primary schools, if all the children of basic school-age are to be given access to basic education by the year 2005.

ii)   *Gender Differentials*

There is a trend towards gender balance in school participation rates at the basic level in Ghana (Table 4). If the objective of universalizing primary education and eliminating wastages by the year 2005 is achieved there would be no gender bias. But the ministry has set a target of reducing gender differentials in Primary 6 completion and JSS 1 entry by 50% by the year 2005 compared with the present level. The flow rates from primary 6 into JSS 1, have been falling for both sexes over the years (see figures 2 and 3 above). In 1994 it was 88.90% for girls and 88.53% for boys. The difference is negligible. What appears to be important to note is that , the planning to reduce wastage and increase the flow rate must not be sex-biased. There is no sound evidence from the results of this study that girls tend to rush into marriage and boys tend to progress into JSS after their primary education. If there were such practices in localized districts of

some regions, the effect is not noticeable in the macro-analytic framework. Gender bias was prominent in the past and the effect of the imbalance at the various grade levels will linger on till the present cohort of basic school pupils are out of the system. New plans must ensure that girls admitted to Primary 1 are not less than the boys to be admitted. In other words efforts should be made to ensure that all 6-year-old girls are registered and retained in school.

iii) *Transition rates*

Even though enrolments at JSS 1 kept expanding during the study period, the yearly increase was not commensurate with the yearly increase in primary 6 output. This was so for both sexes. The implication is that a more vigorous effort will be required to expand junior secondary school facilities and resources, (class rooms, teachers and materials) if set goals are to be achieved.

iv) *Teacher supply*

This study shows that the number of teachers at both primary and secondary schools in Ghana fluctuated over the study years, maintaining a steady increase only in the last three years. About two-thirds of the teachers in the primary schools were trained. while about three-

quarters of those in junior secondary schools were trained. The ratio of about 30 pupils to 1 teacher was quite normal in primary schools. At the JSS level the ratio of 18 pupils to 1 teacher was rather too low. Planning implications are that enrolments at that level could be expanded considerably with minimum increase in teacher supply. Emphasis should be on teaching spaces and teaching materials.

To improve quality of the education imparted and to acquaint teachers with new methods and re-orient them toward the objectives of the new FCUBE programme, it is necessary to train new teachers and retrain existing ones through seminars, workshops and short inservice courses. These strategies are required since the low pupil-teacher ratio of 18 to 1 at the JSS level did not appear to have positive impact on quality of education, judging from the performances of the 1988/89 and 1989/90 cohorts at the Senior Secondary School certificate examinations. Inadequacy in the number of teaching personnel may not have been a significant cause of poor examination results. The causes appear to have been embedded in other factors.

Conclusions and Recommendations

This study has established the need for knowing how to analyze trends in the

school-going population at the basic level in order to be able to make an accurate forecast of future enrolments and make adequate plans for the number expected in schools. If we are to quantify and rationalize educational plans, we must be able to analyze trends in the population data of the present and potential clients of the school system.

This study has also established a necessity for creating baseline data against which to assess progress made at any subsequent period during plan implementation. After setting the bench mark against which to assess any effort made to move towards the attainment of set objectives, studies of this nature should be conducted periodically to detect lags between planning and implementation.

To extend access to all children in Ghana by year 2005, it is necessary to project the six -year-olds for the plan period and inflate the numbers for latecomers who may decide to participate in basic education at different points in time. It is of equal necessity to plan to provide enough teaching resources for the projected numbers, remembering that expansion of classrooms and building of new schools have to be planned well ahead of the time of need.

There should be equal intake of girls and of boys into Primary 1. Gender balance must be geared towards eliminating gender differentials in wastage ratios.

Provision must be made to expand resources significantly for JSS and machinery must be set in motion to assess the transition rates from year to year.

Teachers time appeared to have been slightly underutilized at the JSS during the study period. If other complimentary factors are suitable a pupil/teacher ratio of 24:1 at the JSS level cannot lower the quality of teaching. While ensuring that sufficient number of teachers are trained for the expected upsurge in enrolment, arrangements should be made to retrain old teachers so that objectives of the new national policy on FCUBE could be realized. The University College of Education of Winneba as well as the Faculty of Education of U.C.C. could be strengthened to coordinate such retraining.

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MANAGEMENT OF INSTRUCTIONAL TIME IN SOME GHANAIAN PUBLIC PRIMARY SCHOOLS

A. K. Koomson, A. K. Akyeampong, & D. K. Fobih

ABSTRACT

Providing all the instructional inputs that teachers need for effective teaching in the classroom, undoubtedly, is one of the major pre-requisites for instructional success, but how the instructional time is managed with all those inputs for the attainment of set instructional goals, certainly, is of paramount importance. The study was designed to examine how teachers in twenty-four semi-urban and rural primary schools, which were randomly selected from five out of the ten regions in Ghana, use the official instructional time approved by the Ministry of Education in their respective classrooms. The emergent picture was that about 50% of the instructional time on the average in the schools studied is mismanaged due to a host of factors including : late starting of schools; teacher-lateness to class; and teaching only few subjects on the time table.

Introduction

Teaching as a professional activity, which involves the facilitation of knowledge development and transmission of knowledge and skills to students within the framework of a designed curriculum, is a complex and sophisticated one. The complexity of this activity lies in the fact that the teacher is expected to take vital pre-instructional decisions on what to teach, when to teach it, how much to teach, how to teach it, and how to assess what is taught at any given instructional session (Good, 1979; Gage and Berliner, 1984; Good and Brophy, 1986).

An important feature of these decisions which are crucial for instructional success, is that it is time-bound. In other words, a national curriculum specifying what teachers are expected to do in a given period of time - day, week, term and the whole academic year - is always pre-planned. This means that the underutilization or mismanagement of instructional time will result in a limited coverage of the designed curricula, which in turn, will have tremendous negative impact on pupils' achievement. This assertion has been confirmed by a variety of researches in Third World countries. For example, studies have shown that the amount of time available for teaching and

30

learning academic subjects, and how well the time is used by teachers and students have direct bearing on students' achievement (Heyneman & Loxley 1983, Lockheed & Komenan 1989, Brown & Saks, 1987, Rust & Dalin, 1990).

Highlighting on the determinants of instructional time utilization, Lockheed & Verspoor (1991) observed that

> The annual number of hours available for children to study a given subject in school is determined by three factors : the hours in the official school year; the proportion of these hours assigned to the subjects; and the amount of time lost because of school closing, teacher absence, student absence and miscellaneous interruptions (p.58).

They point out that the shorter the official hours of instruction and the higher the amount of instructional time lost, the lower the level of achievement of pupils in the assigned subjects. Lockheed & Verpoor (1991) also revealed that the length of instructional time in Ghanaian primary schools falls far shorter than world-wide averages. They remarked

> World-wide, the official academic year for primary grades one through six averages

880 instructional hours ... **this time** (emphasis ours) varies depending on the economic status of the country; low and lower middle-income countries have a shorter official school year than upper-middle and high-income countries. However, in some developing countries, the official academic year is substantially shorter than this average (for example, 610 in Ghana), while in others it is longer (1,070 hours in Morocco) p.58.

This shorter length of instructional time in Ghana has been directly linked to the decline in school achievement which was one of the major factors that warranted the design and implementation of the Education Reform Programme in 1987. Six years after the implementation of the Reforms, the then Director General of GES, Mr. John Attah Quaison (1993), in a letter to District Directors of Education in Ghana, remarked

> As you are aware, one of the surest ways of ensuring the attainment of good teaching and learning situation in the school for the delivery of quality education is by maintaining official levels of teacher/pupil contact hours or instructional time in the school. Reports from the monitoring of

(a) Time each lesson started,

(b) Time each lesson ended and new one began,

(c) Total time spent on each lesson, and

(d) Total number of subjects taught in the observed classes on the day of visit.

(a) Total time spent on each lesson,

(b) Total number of subjects taught on the day of visit,

(c) Total time spent for instruction in the classes observed and,

(d) Total time not utilized for instruction.

The researchers in this study restriced the concept of instructional time to "any interaction between teacher and pupils inside or outside the classroom where either the teacher is teaching or the pupils are doing something related to a given subject at a given time or both" (Lockheed & Vespoor, 1991). Therefore, break period, opening and closing of school and sessions in which the prescribedinteractions are not in place did not form part of the operational definition of the concept of instructional time.

At the end of the day teaching time tables and lesson notebooks were collected for inspection. Results of Baseline Test administered and scored by the district directorate of the GES for 1998 for the schools studied were also collected for analysis. Computation of the following were carried out:

Results And Discussion

Time school started

Not even one out of the twenty-four schools visited had the morning assembly on time. Lateness to morning assembly ranged between 10 and 90 minutes, with the non-project (nP) schools being the worst of the three types of schools. One noteworthy observation in this study was that, on the day of visit to the schools, it was observed that 42 (31%) out of the 135 teachers in the schools were absent. In the northern zone, the situation was the worst as 52% of the teachers were absent on the day their respective schools were visited. Teacher absenteeism of this magnitude is a very serious phenomenon insofar as the total instructional time for the day is not only lost but also difficult, if not impossible, to cover what supposedly should have been taught

that day in the given calendar year.

Lateness to school and number of lessons taught :

With respect to lateness to schools 79(85%) of the 93 teachers who came to school on the day their respective schools were visited, reported late. The length of lateness

observed started late. This affected not only the total instructional time for the day but also the total number of subjects taught in a day. As shown in Table 1, the total number of subjects to be taught at a day in the primary school level ranged between five and seven on the timetable approved by the Ministry of Education (MOE).

Table 1 :
Total Number of Subjects Taught

School Type	No. of teachers observed	Total number of Expected Subjects to be Taught (Test)		Total number of Expected Subjects Taught (TOST)		% Of Subjects Taught Per day	% of subjects not Taught Per day
		Total	Average per/day	Total	Average per/day		
Project (P)	34	192	5.6	78	2.3	40.6	59.4
Non-Project (nP)	24	128	5.3	64	2.7	50.0	50.0
Special Project (sP)	27	144	5.3	80	3.0	55.6	44.4
Total	85	464	5.4	222	2.67	48.7	51.3

ranged from some five to ninety minutes (i.e. 8.05 to 9.30am). The implication of lateness to this extent on use of instructional time is quite obvious as some of the day's lessons could not be either treated at all or fully treated. This situation came about as almost all the first lessons

It was observed that less than three subjects on the average were taught in the 24 schools studied. It was found that about half of the subjects on the timetable were not taught, and that all the teachers whose lessons were observed did not follow rigidly the timetable. The teachers observed

taught subjects of their choice and left out others that they either have not prepared for or deemed to be less important. Mathematics and English were the most frequently taught subjects in the classes observed. With this practice, pupils in these schools are being denied the knowledge and skills they are expected to gain from those

about 45% of the total time for instruction was wasted. As shown in table 2, the instructional time utilized and wasted varied from one type of school to the other. In the (P), (nP) and (sP) schools, total instructional time utilized on the average was 49.8% 47.9% and 66.4% respectively. The corresponding time

Table 2 :
Total Instructional Time Utilized and Wasted.

Type of School	No of Tea-chers	Total (A) Duration of Expected Instructional Time (EIT) in Minutes		Total (B) Duration of Instructional Time Utilized (ITU) in minutes			Difference between. A. & B Duration of Instructional Time Unutilized (ITUn) in minutes		
		Total EIT	Ave EIT	Total ITU	Ave ITU	% ITU	Total ITUn	Ave ITUn	% ITUn
Project	34	9180	270	4573	134.5	49.8	4607	135.5	50.2
Non-P Special	24	6480	270	3101	129.2	47.9	3379	140.8	52.1
Project	27	7290	270	4843	179.4	66.4	2447	90.6	33.6
TOTAL	85	22950	810	12517	4431		10433	336.9	
AVE		7650	2 70	4172	147.7	54.7	3478	122.3	45.3

subject areas left out - a phenomenon that suggests mismanagement of instructional time.

Total Instructional Time
used and wasted

It was found that total time spent on actual instruction in the classes observed was 55% of the day's instructional time. This means that

wasted in the schools on the average was 50.2% 52.1% and 33.6 % respectively. The impact of this mismanaged instructional time on pupils' achievement is even more significant when assessed in the context of the Baseline Test results administered and compiled

by the district directorate of the respective schools.

The overall average performance of pupils in the three types of schools as shown in Table 3 corresponds to the instructional time wasted. Pupils in the non-project schools which recorded the highest wastage in instructional time had the least scores in both the Mathematics and

on each lesson by the teachers observed. As depicted in Table 4, the total time spent on most of the subjects observed in a sample of 23 lessons, was either extremely shorter or longer than the stipulated time on the timetable. This misappropriation of instructional time, which was observed in most of the lessons, took the form of either ending the lesson earlier or later than the specified period on the timetable.

Table 3

Pupils' Achievement Levels in Mathematics and English

Type of School	Average Score in Percentage %					
	MATHEMATICS			ENGLISH		
	Boys	Girls	Average	Boys	Girls	Average
Project	23.7	21.2	22.5	27.9	23.9	25.9
Non- Project	16.6	14.7	15.7	20.1	19.5	19.8
Special Project	35.9	30.9	33.4	36.4	32.4	34.4

Source :
1998 Baseline Test Results from the Districts Studied

English tests, while the special project schools where the instructional time wastage was the lowest, had the highest scores on both tests.

Average Time Spent on Each Lesson

An equally significant observation made in the study was the great variation in instructional time spent

The duration of misappropriated instructional time ranged between plus or minus five to over plus or minus fifty-five minutes per lesson of either 30 or 60 minutes duration. In all the 23 classes observed, as shown in Table 4, there was only one teacher in school (S_5) in P4 who tried to teach with compliance to the timetable but with slight deviations. If lessons expected to last for 60 minutes could go twice

Table 4 :
Distribution and Utilisation of Official Instructional Time in 5 schools

Type of School	Class	No. of subjects per day (Expected)	No. of subjects taught per day (Observed)	Total Official duration of subjects (Minutes)	1st subject & Duration (observed)	2nd Subject & Duration (Observed)
(P) S₁	1	5	2	270	M. 123 (60) + 63	E 100 (60) + 40
	2	5	2	270	M 133 (60) + 73	E 107 (60) + 47
	3	5	3	270	M 65 (30) + 5	E 77 (60) + 17
	4	6	2	270	E 88 (60) + 58	IS 55 (60) - 5
	5	6	3	270	E 84 (60) + 24	E 84 (60) + 24
(P) S₂	1	6	1	270	M 70 (10) + 10	-
	2	6	1	270	-	E 77 (60) + 17
	3	6	2	270	M 125 (60) + 65	E 45 (60) -15
	6	7	2	270	M 100 (60) + 40	IS 70 (60) + 10
(nP)S₃	1	6	2	270	M 20 (60) - 40	E 50 (30) + 20
	2	6	1	270	M 37 (60) - 23	-
	3	6	2	270	M 43 (60) - 17	E 70 (30) + 40
	4	6	2	270	M 110 (60) + 50	BK 25 (30) - 5
	6	6	3	270	M 70 (60) + 10	E 20 (60) - 40
(sP) S₄	1	5	2	270	M 102 (60) + 42	E134 (60) + 74
	3	5	3	270	BK 15 (30) -15	M 76 (60) + 16
	4	5	3	270	M 69 (60) + 9	E 108 (60) + 48
	5	5	3	270	M 93 (60) + 33	E 89 (60) + 29
(sP) S₅	1	5	3	270	M 80 (60) + 20	E 66 (30) + 36
	2	5	4	270	M 80 (60) + 20	E 58 (30) + 28
	4	6	4	270	M 75 (60) + 15	E 66 (60) + 6
	5	6	3	270	M 50 (60) - 10	ES 53 (60) - 7
	6	6	2	270	E 107 (60) + 47	GL 80 (60) + 20

Type of School	Class	3rd Subject & duration (Observed)	4th Subject & duration (Observed)	Total Time utilised in the subjects t aught	General Remarks
(P) S₁	1	-	-	223	Lessons started at 8.30
	2	-	-	240	No instruction after break
	3	GL 68 (60) + 8	-	210	at 12.30 noon at P4
	4	-	-	143	
	5	GL 58 (60) - 2	-	221	

Type of School	Class	3rd Subject & Duration (Observed)	4th Subject & Duration (Observed)	Total Time utilised in the subjects taught	General Remarks
(P) S2	1			147	Lesson started at 9.35
	2			147	Had only one break from
	3			170	11^{30}- 12^{20} No instruction
	6			170	after break
(nP)S3	1	-	-	70	Lesson started at 9.00.
	2	-	-	37	P2 teacher was drunk and
	3	-	-	113	spent time moving from
	4	-	-	135	class to class and finally
	6	GL (30) + 43	-	163	sleeping.
(sP) S4	1	-	-	236	P6 was used for group test
	3	E 115 (60) + 55	-	206	
	4	IS 25 (60) - 35	-	202	
	5	ES 55 (60) + 5 -5	-	237	
(sP) S5	1	GL25(60)-35	-	171	No instruction after
	2	ES92(60)+32	GL16(60)-45	245	break at 12^{15} - P1 & P6.
	4	ES60(60)0	GL42(60)-18	243	Used P3 for Group test
	5	E115(60)+55	-	218	
	6	-		187	

Keys : M (Maths), E (English), IS (Integrated Science) GL (Ghanaian Language), ES (Environmental Studies), BK (Bible Knowledge).
Figures in bracket refer to official duration of subjects taught.
+ sign denotes time spent above official duration of subjects taught
- sign denotes time spent below official duration of subjects taught.

beyond the stipulated time or end just after twenty minutes, then the observed and reported low achievement levels in our primary schools could be attributed in part to poor utilization of instructional time. One contributory factor to this misappropriation of instructional time was that in some of the schools there were neither bells nor drums to signal the beginning or ending of a particular period. Teachers, therefore, depended more on their own estimation of time that did not correspond to the official time allocated for the subjects on the timetable.

Conclusion

The problem of utilization of instructional time in the schools and its allied teacher absenteeism and lateness to school lie exclusively in the domain of relaxed internal and external supervision. Headteachers

have shirked either their responsibility of managing their schools effectively or failed to receive the support from the district education office. Records from the schools' logbooks indicated that although the district education officers visited the schools, their visits focused not on how instructional time is utilized but on whether headteachers accurately kept accounts of fees collected for the District Directorate. In their comment on managing instructional time in ineffectively managed schools, Atakpa & Ankomah (1998) made a remark which is consistent with the above view point and underscores the key findings in this study. They point out that :

> *... marking class registers and keeping of staff attendance books did not serve any purpose. This was because lateness and absenteeism on the part of both teachers and pupils had been accepted as normal by the heads. In some of the schools even records on staff and pupils attendance do not exist. The heads do not also have time to supervise teaching and learning in the schools since they claim they are overburdened with teaching themselves. Consequently the output of work was sub-standard. (p.9).*

Thus, to improve on the effective use of instructional time in Ghanaian schools, there is the need for regular external supervision that focuses on supporting teachers to maximize the use of instructional time.

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MANAGEMENT AND INTEGRATION OF SCIENCE RESOURCES IN GHANA'S EDUCATIONAL REFORM PROGRAMME

T. A. Ossei-Anto

ABSTRACT

This paper attempts first to review the state of affairs in educational institutions with reference to science education vis-à-vis the expected standards. Secondly, the effort of Government, through the Ministry of Education and the Ghana Education Service, to provide pre-university institutions with adequate resources for science teaching, especially from 1986 to 1995, are discussed. Thirdly, the identified problems which may have eluded the attention of planners and administrators in charge of the educational reforms are mentioned and analyzed. Finally, probable solutions and suggestions are made to assist the authorities concerned to revisit the blueprint of the Educational Reforms Programme and make the necessary modifications.

Introduction

The need for a change in the teaching and learning of science in Ghana has long been identified and efforts have been put in place to address this issue as outlined in the aims and objectives of the Educational Reform Programme. However, the rate at which the change is taking place and the adequacy of efforts made leave much to be desired. Investigations conducted so far indicate that though some attempts have been made to assist students learn science by doing, with guidance and instruction from trained and competent staff, and in an environment that encourages teaching and learning, a lot more needs to be done. Institutions in desperate need are those found in the rural areas as well as the newly established community-based senior secondary schools. Many schools cannot teach meaningful science except to teach students to do rote learning to enable them pass examinations. This has come about due to the inadequate supply of both human and material resources. An efficient and versatile human resource is a central key to the development of science education in the educational reform programme. The environment and infrastructure including workshops and laboratories provide an exciting and very important source of enhancement in science teaching and learning. However, teachers and educators have often neglected the environment as an unique resource

available for effective use. Science teaching will definitely be better done if the issue of inadequate supply of science equipment and materials is also tackled with zeal.

The Personnel Factor

It is generally conceded that the success of any human endeavour is closely related to the quality of the personnel who perform tasks necessary for the achievement of purpose as well as to conditions that affect their physical and mental well-being. This assumption is as applicable to school as it is to any organized human effort. The extent to which public education succeeds in delivering services with an effective use of scarce resources (inputs) will depend largely on the quality of the personnel engaged in the educational process and on the effectiveness with which they discharge individual and group responsibilities.

The environment and space are important. A well designed science education programme is essential, but leadership is vital. Money, equipment and materials are significant, but the most crucial single factor in the science education process is the yet unmotivated science resource personnel charged with the task of effecting desirable changes in children. Science personnel within the context of this

paper refers to the classroom science teacher and school laboratory technician; science teachers and laboratory technicians at the resource centres; the scientific community (GSA, CSIR, GAST); stakeholders / beneficiaries (NGOs, GES, VALCO, UNILEVER, parents, students, etc.), and the West African Examination Council staff.

This section will attempt to address the following :

a) The adequacy and calibre of science teachers before and during the reforms at the various levels of pre-university education.

b) Steps being taken to improve the existing situation.

c) Problems and recommenda-tions.

Before the Reforms

Science teacher education developed from the training of teachers to teach Nature Study and Hygiene. A one-year rural science programme was later mounted at Bagabaga Training College, Tamale, to train Certificate 'A' post middle and secondary to handle Science at the Primary and then Middle schools. The elementary school science syllabus at that time became the pivot of the science

teacher education programme in training colleges. In 1973, a two-year science specialist programme was run in selected colleges throughout the country for a period of four years and this gave way to the three-year post-secondary science programme. Thus, in March 1975, the Agbenyaga Committee was appointed to review the entire teacher education programme. It recommended the establishment of a new teacher training course to be called "The three-year Post-Secondary Course" to replace the then two-year Post-Secondary course. Through this programme, the three-year "quasi-science specialist" replaced the two-year science specialist course as well as the two-year post-secondary science programme. In January 1981, GAST Teacher Training Panel with support from NTTC was to diagnose the problems of science teacher education in Ghana. This sparked off a chain reaction in science teacher education in the country.

Thus before 1987, the calibre of teachers qualified to teach science at the basic school level included

i.   the Certificate A post-middle and secondary,

ii. the two -year specialist science teacher, and

iii. the one-year rural science teacher. This requirement assumed that the science teacher had a professional training as a teacher as well as being grounded in the techniques and methods employed in the teaching of science, organizing and improvisation of basic science apparatus, programmed instruction, teaching mechanisms and many other new concepts coming in as a result of the dynamic nature of science. The number of qualified teachers were woefully inadequate to meet the school requirements. Hence pupil teachers with middle school certificates and GCE 'O' and 'A' levels were employed to teach and these taught science as well. Most of these teachers had very weak science backgrounds and so perpetuated the cycle of weak science backgrounds for the pupils they taught.

At the second cycle level - Secondary and Teacher Training levels - the basic qualification of the science teacher as spelt out by GES included at least the possession of a specialist certificate, a diploma certificate in science education and a bachelor's or master's degree in science from a recognized university, preferably with an education background. However, arising from the inadequacy of professional competent teachers, non-professional graduates from the University of

Ghana, Kwame Nkrumah University of Science and Technology, 'A' level holders, and in some cases, post secondary teachers found their way into the science classroom.

With laboratory technicians, they are required by the GES to possess a certificate or diploma in Laboratory Technicians course. But like the teachers in the teaching profession, their number is very low. Hence non-qualified persons such as 'O' level and Middle School leavers have found their way into the system as laboratory assistants or attendants. Before 1992, the statistics available at the Lab-Tech office at UCC showed that only 222 laboratory technicians were trained and turned out to GES. According to Association of Science Educators *et. al.* (1970), the establishment of a school of a population of 1200 students needs five laboratory technicians. Unconfirmed reports indicate that only about 60 % of laboratory technicians trained by UCC are still with the GES. The rest are with industries where conditions of service are better for them.

Before and in 1987, the GES, GAST and other stakeholders such as the Overseas Development Agency (ODA), pooled their resources together to prepare the teachers in the system for a take-off of the programme. In September 1987, all middle and continuation schools were converted to Junior Secondary Schools. Between 1988 and 1990, GAST organized courses, workshops and conferences to discuss the syllabi of the various science subjects (Biology, Physics, Chemistry and Core Science) at the SSS level and made recommendations to the GES and MOE. GAST, supported by the scientific community and other stake holders and beneficiaries, also started with the preparation of GAST subject textbooks to guide its members during the implementation process of the reforms. GAST in 1990 also reviewed the existing teacher training science syllabi. , It also organized refresher courses at its AGM to further update their knowledge. As a result of these seminars, a source book for college science tutors was drafted and tried out in the colleges.

With financial assistance from ODA, JSSTEP, courses were equally mounted by the Institute of Education, UCC. Science Resources Preparation Centres were developed purposely to help science teachers prepare and become conversant with the variety of instructional materials that they would be using. In 1990, the GES / MOE organised orientation courses for science teachers in secondary schools at four centres in Cape Coast. At these centres or courses, teachers were taken through the syllabi and also given political education on the rationale for the reforms.

During the Reforms

The first batch of the JSS students came out in 1990 and in the 1990/91 academic year the Senior Secondary School (SSS) programme was started. The calibre of teachers at the primary level had not changed since the reforms had not touched this level yet. In July 1991, primary six teachers were called to the respective district capitals and given orientation courses in the teaching of the Primary Six science syllabi for a period of two weeks.

Because of the shortness of the duration, these orientation courses hardly made any meaningful impact. Hence one might say, the calibre of teachers was about the same as before the reforms. Since 1991, little effort has been made to give in-depth refresher courses to the primary school teacher on the teaching of science. However, trends in the percentage of trained teachers since 1987 in the primary schools has shown an appreciable increase,

Table 1

Trends in the Percentage of trained teachers in the Public Basic Education Level 1986 - 1994

YEAR	PRIMARY	JSS
1986/87	55.8	64.6
1987/88	57.9	68.0
1988/89	60.1	71.8
1989/90	66.4	64.9
1990/91	66.1	75.9
1991/92	73.8	72.1
1992/93	72.4	76.3
1993/94	73.3	75.6
1994/95	81.6	78.0

Source : Ministry of Education, Accra, 1997

Class 1 - 5 teachers were also called at zonal levels and given training in the teaching of science by resource personnel organized from the District Education offices.

pre-supposing that trained teachers have equally increased (See Table 1 column 2). But the percentage increase of 25.8 % between 1986 and 1995 is however small when

weighed against an increase in the number of primary schools by 40 % within the same period. This might suggest that there was no substantial improvement in science teaching at the primary school level.

Since the initial orientation of the JSS science teachers in 1987 not much effort has been made to raise the quality of JSS science teachers. Tufuor (1989) in a research conducted showed that out of 27 teachers interviewed in the Cape Coast District, 2 were diplomates, 13 were post-secondary trained teachers and 12 were 'A' level holders. All the post-secondary trained teachers had weak science backgrounds and two had no science passes at all. If this is the gloomy picture in the Cape Coast district, which is the cradle of western education in Ghana, then God help Adukrom JSS in the Eastern Region and Kpasinkpe JSS in the Northern Region.

These findings are supported by Dapilla (1996) in a research conducted to find out the "state of science teaching in the JSS in the Jirapa-Lambusie District of the Upper West Region of Ghana". He found out that only 20 % of the 30 JSS science teachers were actually qualified to teach science because they specialized as 3-year post-secondary science teachers. 80% of the teachers also expressed the difficulty of teaching science at the JSS level and these were those who were 3-year post-secondary teachers who specialized

in other subjects. He therefore, concluded that the teacher background to teach science in the JSS in the Jirapa-Lambusie district was unsuitable.

A cursory look at the statistics in Table 1 column 2 shows that adequacy and quality have not improved over the years. The change in the trends of the percentage of trained teachers between 1986 and 1995 is only 13.4 %. This does not augur well for primary school teachers and re-inforces the findings by Tufuor (1989) and Dapilla (1996). Thus, the basic education system still harbours unqualified science teachers.

As stated earlier, the SSS programme took off in January 1991, when the first batch of JSS students came out in July, 1990. In October 1990, in-service courses were organized in Cape Coast to give orientation to the science teachers towards the implementation of the programme. In 1991, a similar course was organized at Winneba for those who were not in the system in 1990. The calibre and adequacy of science teachers in the SSS remained as before the implementation of the programme due to the expansion of intake and also the policy requirement that all SSS students read core science. The periods (teaching load) of the science teachers increased. However, there was no appreciable corresponding

increase in teachers. An examination of the trends in the numbers of teachers in the SSS in Table 2 column 4 from 1992 to 19995 shows a negligible increase. This is so because the trends in the number of teachers in the Polytechnics, Diploma Awarding Institutions, and Universities (Table 2, columns 7,8 and 9) did not see any marked increase; hence they could not increase their products either. The Diploma awarding institutions and the Universities rather saw a drastic drop in the trends in the number of trained teachers (Table 2, columns 8 and 9).

diplomates and professional graduate teachers. However the training colleges lacked qualified teachers (e.g. for the 1996/97 academic year, Bimbilla E.P. Training College had no science teacher, and Tamale Training College had only one).

Steps Being Taken to Improve the Existing Situation

1. There have been sweeping changes in the Teacher Training science education programme since 1990. The post-middle Teacher Training programme was phased out and

Table 2

Trends in the Number of Teachers in the Public System by Level 1986 - 1994

YEAR INST.	PRIMARY TTC	JSS	SSS	TECH. INST	TCC	POLY TECH.	DIP INST.	UNIV.
''86/87	64,357	31,633	7,741	737	968	387	180	-
''87/88	63,367	32,612	7,813	760	964	368	192	1,462
'88/89	62,670	34,584	8,528	792	1,001	386	184	1,163
'89/90	62,859	35,262	8,087	824	981	393	185	1,361
'90/91	62,823	30,708	9,195	882	952	406	192	1,115
'91/92	66,378	33,395	10,016	869	950	410	207	1,273
'92/93	61,724	32,896	11,876	863	967	411	41	1,379
'93/94	62,314	36,110	11,846	855	1,004	419	50	1,349
'94/95	60,947	35,622	11,401	862	1,028	487	52	1,400

Source : Ministry of Education, Accra, 1997

The quality of teachers at the training colleges improved. Specialists and graduate non-professionals were in 1991 removed from the system to make way for

replaced by the three-year Post-Secondary science teacher programme. In this reform, two science teacher programmes are run by two categories of training

colleges. Group 1 colleges are designated Science Training colleges. The student teachers here specialize in teaching science and science-related subjects such as Agricultural Science and Technical Drawings. Group 2 colleges are designated Arts and Business Training colleges. They run a basic science programme for two years to enable them teach science at the primary school. They are examined in their Part I examinations as an external paper. This affects their certification, hence students are usually serious. But the quality and adequacy of qualified science teachers is still below average at the basic level (Tufuor, 1989; Dapilla, 1996).

2. The establishment of Regional Colleges of Sciences has been proposed. It is hoped that very soon these will take off. The three-year post-secondary science programme is to be upgraded to the status of Diploma programmes.

3. Opportunity has been offered to Diplomate science teachers to pursue a 2-year post-diploma programme to upgrade them- selves to degree status at UCC and UCEW. This will im- prove the calibre of personnel at the SSS and TTC levels.

4. Co-ordinators of Science Resource Centres have been given orientation in the management of science resources centres in the country. This includes training in the performance of all the experiments in the science syllabi using the materials and equipment provided at the centres. Laboratory technicians have also gone through similar orientations.

Problems Encountered by Human Resources in the Reform

1. It has been realized that the gifted and above average students are unattracted towards the teaching profession but are more inclined towards Medicine, Engineering and Administration, etc. The reason is that the teaching profession does not offer any incentives. It is, indeed, an irony that whereas the nation is trying to set up industrial plants in accordance with the latest technology in science education, we are content to follow out-moded and stereotyped practices.

2. It has also been noted that since the initial euphoria of orientations, nothing has been done to give the science teacher in-service training.

3. Boakye (1986), cited by Tufuor (1989) reported that the national organizer of the reform programme identified among other things the inadequacy of staff, i.e. science teachers and laboratory technicians. No meaningful records/statistics of science teachers nation-wide have been made available to advise science teacher producer agencies on the needs of the country.

4. The esoteric programmes presently available in the faculties of our universities do not meet the calibre and requirements of the reforms. Also, the science education programme as run by the Department of Science Education at UCC is far removed from the aims and objectives of the reforms, especially at the second cycle level. If really the graduates are to handle the secondary school science programmes as spelt out in the aims of the B.ED Science Education Programme, then the teachers should be given training in the syllabi of the SSS course content. This includes both theory and practical requirement.

Suggestions

1. All science teachers should be given up-dated in-service training as done for the coordinators of the science resource centres. Alienating the classroom science

from the science resource centres is like trying to separate school science into "practical" and"theory" lessons and it is the same as trying to perpetuate a dichotomy which is an antithesis of true science teaching.

2. Personnel development should be pursued by GES/MOE so as to attract, retain, and improve the quality and quantity of science personnel needed to implement the programme and achieve results. This could be achieved through :

i. Improving the performance of personnel in their present positions (in-service training).

ii. Developing key skills of selected personnel so as to fill anticipated vacancies (staff development).

iii. Promoting the self-development of all personnel in order to enhance their influence as individuals and to facilitate need satisfaction (staff development).

If these are done, then the best brains can be equally attracted and retained in the science education system. Through personnel development, science personnel can experience

personal growth, professional growth, upward mobility, motivation and job security.

3.   Statistics should be compiled on the trends in the number and quality of science teachers and laboratory technicians at the pre-university level. This will enable GES/MOE to produce answers to the following questions :

i   How many science teachers and laboratory technicians are there within the system ?

ii   How well have they been trained and how well have they achieved the goals of the science education programme ?

iii How long will it take to achieve the goals with the quality and quantity of present personnel ?

iv   How much money will it cost to train a quantity of science personnel ?

4.   The science programme run in the universities should be restructured to address the aims and objectives of the reforms. The programmes should direct their attention on "hands-on" and "minds-on" objectives. This will produce the science and technology minded citizens who are needed in the contemporary world.

5.   It is worthwhile for the GES/MOE to draw a comprehensive and consistent science education centred policy document to ever influence issues centred around science personnel. This therefore calls for the establishment of a Directorate for Science education at the GES.

Instructional Equipment and Materials - an Underlying Factor for Successful Educational Reforms

Learning by doing is one of the cardinal principles of teaching science. Experimentation has put many theories on a sound footing and has also resulted in the rejection of many. History reveals that many beliefs and superstitions were thrashed out from the minds of people as a result of experimentation. The achievements of modern science are mainly due to the application of the experimental method. Practical work must therefore be made a prominent feature in any science course (Sharma, 1995).

If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information, and it could degenerate into a new superstition. For some time now, many science teachers have had no option but to resort to the lecture method partly due to the demands of

the type of external examinations students are prepared for, or to the inadequacy or lack of science materials and apparatus, such as microscopes, telescopes, burettes, glassware, library books, science museum materials, standard textbooks, workbooks, teachers' manuals, chemicals, etc.

Ghana's sweeping educational reforms theoretically lays greater emphasis on hands-on education, in addition to minds-on and values-on education. Considering the objectives of the reforms, one would expect the Government to supply adequate and appropriate science equipment and materials to all levels of education. Unfortunately, this expectation has not been met.

A survey of science equipment and materials at various levels of the formal education system precipitated the following findings :

i   Kindergarten through Primary Six : Supply of basic science apparatus and materials like test tubes, beakers, etc. are still being considered. The environment is therefore being prepared to serve as the resource for basic science teaching to a large extent.

ii Junior Secondary School level : In 1988/89 academic year, each school was supplied with an average of two boxes of assorted science materials and equipment including General Science text books. The supply enables the science teacher to hold demonstration lessons for five groups of at least eight students each. Some of the items in the science kit are as follows : sieves, measuring cylinders, rubber bungs, funnels, hand lenses, magnets, glass tubes, wire gauze and chemicals like Benedict's solution, iodine, potassium permanganate, charcoal powder etc.

iii Senior Secondary School level : The Government already has a scheme for supplying schools with science equipment and materials though inadequate. The Government must be given credit therefore for establishing and equipping Science Resource Centres throughout the country. An amount of £ 20 million has been committed by Government for the project. The establishment of the Science Resource Centres is a laudable idea because students who hitherto had no access to some equipment and materials can now have hands-on experience at these centres.

Each Science Resource centre has equipment and materials adequate for practical lessons. The Biology department, for example, has altogether 745 pieces of equipment and the co-ordinators of the centres confirm the adequacy of the supplied

equipment and materials. There are also at least two computers supplied to each department to aid the teaching-learning process. In addition, the possibility of connecting the centres to the Internet is being considered. This will expose students to international/scientific websites, software and programmes and help them rise up to the challenges of the scientific advancement of our modern world.

The project is more or less a national one and the Government is ensuring that Philip Harris Company Ltd., which is responsible for furnishing the centres with equipment and materials, hands over to the District Assemblies the responsibility of replenishing the centres. The main objectives for establishing the science centres have been found to be the following :

i   Serve as teaching centres to supplement existing facilities in secondary schools and give ample opportunities for practical work using modern facilities and techniques, including the use of computers.

ii   Provide tuition for students in schools without well-equipped laboratories.

iii   Serve as centres for running in-service training programmes for teachers of science at JSS,

SSS, and Technical education levels.

iv   Serve as venues for students to engage in the development of their science projects.

v   Provide facilities for running Science, Technology and Mathematics Education (STME) clinics for girls.

The benefits of the project when completed are expected to be substantial. These include an improvement in the teaching and learning of science, increased enrolment of science students at the secondary and tertiary levels and a general increase in enthusiasm for the learning of science.

Problems Affecting Science Teaching and Learning due to the Inadequate Supply of Science Equipment and Materials

1.   The delayed supply of basic materials and equipment to supplement resources from the natural environment and the lack of use, or inadequate use, of the environment as a resource by some teachers constitute a problem that needs serious attention.

Most theorists in social psychology believe that many of our attitudes are formed during

childhood and therefore emphasise the role of basic learning principles at that stage. The development of positive attitudes towards science must therefore be inculcated into the child from kindergarten through primary school. Once the psychomotor skills are developed the interest generated for science will serve as the momentum for any further scientific adventure beyond the primary stage. If a child's natural curiosity and desire for manipulation of objects is not nurtured at the tender age, there is no guarantee that when the child encounters the SSS science equipment at the Science Resource Centres, he would be attracted to science. The use of learning aids helps the intellectual development of the child and his scientific process skills. This implies that the earlier the child is exposed to learning aids the better. Another advantage in the early use of science equipment and materials is the minimization of the likely formation of misconceptions in the child's mind.

2. The establishment of the Science Resource Centres is laudable but there are related problems that need urgent attention :

a. The science centres are meant for practical work to supplement science teaching and not to replace teaching in satellite schools. However, due to inadequate publicity and education, the impression created is that teachers in satellite schools have two options, that is either to conduct lessons at the centres with the assistance of trained staff or just observe as the centre staff conduct the practical lessons.

b. The cost of transporting students to and from the Science Resource Centres, excluding the maintenance of the vehicle, is quite substantial. Centre co-ordinators complain that funds needed for the running of the buses are not readily available.

c. The objectives of the project include developing computer literacy among teachers, students and other citizens of the nation. However, the inadequate number of computers makes the objective highly unachievable as projected. Each centre has at most two computers in each laboratory meant to serve groups of students, some numbering up to 40.

d. According to the official criteria for the selection of the centres, the 110 centres should be so located such that all 452 Senior Secondary schools in Ghana would have access to the centres. For cost effectiveness, each centre is expected to serve about five schools. So far, with an average of three schools being tried out, there are disturbing problems with the time-tabling. Currently, some schools have four or more streams of science students in SSS 3 alone. If four or five schools are assigned to one centre, only SSS 3 students may have access to the centre. In addition to this problem, centre teachers and technicians will be overworked, if they have to work all day long from Monday to Friday in order to accommodate all schools.

e. If the Science Resource Centres, as at now, cannot adequately cater for all elective science students, one may ask the following question : "How do core science students, as well as students from teacher training colleges and technical institutes benefit from the centres ?"

Suggestions

1. The economic status of the nation may not be capable of supporting the importation of all the required equipment for all schools. In the light of this, it is strongly suggested that Science Improvisation Centres (SICs) be established at vantage points or as annexes to the Science Resources Centres (SRCs).The GES in conjunction with GAST should mount programmes to give science teachers training in how to improvise materials to meet the requirements of the science syllabi. The products from the Improvisation Centres could also be used to feed rural schools where necessary. The Government must, as an incentive, create special awards on regional and national basis for the best improvised science teaching aid of the year. The criteria for the award may include the least costly item yet most affective in terms of accuracy, durability and easiness in manipulation.

2. Teachers accompanying students to the centres must have no lesson in their own schools for the day they would be at the centres. Thus, the time-table of the schools concerned must be adjusted so that students do not miss lessons.

3. The number of schools per centre should be maintained at three as much as possible. If the number is increased

to five, there may be the need to have SS1, SS2 and SS3 students visiting the centres on rotational basis just once a month. How that will be done and the ease with which it will be done is obviously going to pose more problems. This points to the fact that the supply of equipment, apparatus, etc. to all schools or institutions must not stop with the establishment of the Science Resource Centres. Some activity-based science teaching must go on in the individual educational institutions.

4. The Science Resource Centre Co-ordinators should be encouraged to plan activities for, and also visit, training colleges, technical institutes etc. to assist with science teaching, instruction and experimentations (practicals).

5 Well-equipped libraries should be set up to help students do some personal research or seek more scientific information.

6. Science museums should also be set up to serve as model for emulation for successive generation of students.

7. Science teachers should be encouraged to write suitable textbooks related to children's experience and the environment.

8. Considering the present state of affairs, drivers of the Science Resource Centres' vehicles must be motivated just as the teachers and technicians. This will make all staff concerned conscientious enough to make it possible for the project to take off at least as the identified problems are solved with the desired swiftness. Monetary incentives will not be out of place for them.

9. Considering the financial burden on Government, all beneficiaries of the educational system should be encouraged to assist materially and financially. These beneficiaries include industries, private business concerns, non-governmental organizations and banks.

Environment and Space

The picture of the environment as a resource base for science teaching is reflected by these two objectives of Primary Science :

1. To introduce the pupil to the world of science by exploration and experimentation according to his interest.

2. To develop his ability to observe things around him more closely so that he can perceive relationships among objects and phenomena.

These objectives can be re-stated in operational terms in the following example. In their environment pupils will see animals, and several observations could be made. They could make notes of their observations on feeding, mating habits, breeding, fighting, note where they rest, how many young ones at a time, what the young look like, how they feed or are fed as well as what types of food they take in comparison with that of the parents etc. The list could go on.

The above underscores the importance of the part that the environment (i.e. school and community resources) can play in developing scientific attitudes in the pupils which will lead them to become scientists in the long run.

School, Building and Ground Resources

The nature of the curriculum and the energy of the teacher are the major considerations or factors in determining the extent to which resources outside the classroom/ laboratory are used for science. The attitude of the administrator/ headmaster is also important. However, certain aspects of the location and nature of the school plant and grounds make it easy or difficult for the teacher to extend his teaching beyond his classroom/ laboratory. Where those concerned

with planning are aware of many possibilities for extending science teaching, much can be done to make it possible for teachers to use extra classroom resources.

There are many resources which the science teacher can utilize outside the classroom, but which are within the school compound. The school library for instance, provides obvious service which cares for the needs of the science department along with those of all other groups in the school.

In addition to service facilities, certain aspects of the school building and its equipment can become the basis for science teaching. The audio-visual equipment, the dark-room for photography etc. are examples of the many resources.

Other science facilities may be incorporated into the school plant. An aquarium/pond for ecological studies, rabbitories, a weather cock, a rain gauge, etc. are a few of the facilities that could be incorporated to enhance science teaching/learning.

Community Resources

In science, as in all school subjects, the community can become the classroom, i.e. the community becomes an extension of the classroom/laboratory. The science teacher is particularly fortunate in that so many of the community's

resources relate directly to his field of study. In Biology, for instance, one thinks immediately of the zoo, parks, farms, the local hospital, sewage disposal plant, water systems, factories producing food and a lot more others. Natural resources which should be utilized are rivers, streams, swamps, ponds, forests and savannah areas. An aid to the effective use of these resources could be the preparation of a filing system in which each resource is listed by name; location when it is opened, the person to contact for visits and other pertinent information regarding it.

Factories that make chemicals, or products involving chemical processes, are effective aids to classroom instructions in chemistry. Industries that produce petroleum products, glass, paints, plastics, synthetic rubber, metals and alloys, and many other such materials can be visited by the chemistry students. Direct experience is essential to effective learning and fortunate indeed is the school located in a community that has variety of industrial establishments.

Much demonstration materials and raw materials for making equipment are available in the community. Scrap materials can usually be obtained locally at low or no cost at all. Samples of raw materials and industrial products serve to relate life of the community and the work of the

school. With planning, the study for any of the sciences can become, in fact, a school-community activity. A very important resource in the community is the local residents with specialized abilities or backgrounds (e.g. physicians, dentists, nurses, engineers, technicians, etc.). With the increasing emphasis on individual guidance for students, many specialists can make lasting contributions to the education of the youth by talking to them about the opportunities in the professions and the qualifications necessary for pursuing them.

Hence, it is evident that the community is not so remote as it may seem. The school building and grounds are rich resources for physics, biology, chemistry as well as elementary science experiences, and as stated already, can become and should be an extension of the classroom/laboratory. What then can be done to realize the achievement of the two stated objectives, for there is no gainsaying the fact that field experiences provide first-hand experiences which are more lasting and worthwhile than all the classroom lectures ? What can government do for teachers to achieve this realisation i.e. in terms of encouragement (motivation), in-service training/workshops; and provision of finance to carry out some of the field trips etc. ? What can the community do and should do ? and

what should be the teacher's role in this aspect using environment as a science resource base ?

The Science Teacher's Role

It is quite evident that very few science teachers make use of the environment. No doubt there are a lot of constraints, but every science teacher, no matter at what level, should make use of the environment and its resources. As an adage goes "one direct experience in the environment is worth a thousand pictures or explanations". Another re-echoes that "experience is the best teacher." The science teacher must remember that the environment is an extension of his laboratory in that,

- every classroom has its potential extension into the community in search of people, places and events that constitute community resources.

- such resources begin in and around the school building itself.

- education is not static, but is affected by many social forces. Therefore, a static blue print for the use of the community resources would have little value. Community resources are related to the needs and goals of the groups involved. The science teacher must therefore make the maximum use of the environment which constitutes the community resources by :

i   exploring and exploiting the limitless teaching/learning materials that abound in it ;

ii giving the students/pupils first hand experiences by undertaking field trips and visits to places of scientific interests, which are related to the children's field of study in science;

iii bringing the community into the classroom by way of organizing lectures/talks related to science and inviting science personnel in the community to take part ;

iv organizing science fairs/ exhibitions which will draw the whole community into the school. Such fairs need not be organized using very sophisticated science equipment. The use of scrap and other simple materials for the fair would be a very good beginning. Students and pupils come to exchange ideas, parents see at first hand the efforts the school is making to bring science to the doorsteps of the community through their wards a simple praise from a parent of science personnel at such gatherings of a student's project, could lead to a scientific care. An appeal for science materials at such gatherings could yield tremendous responses in kind and in cash.

In all, the science teacher must realize that his teaching should be active and dynamic, in keeping with active children and a dynamic universe and hence develop a competency in the utilization of the environment to enhance his teaching.

The Community and the School

At the inception of the Junior/Senior Secondary School Programmes, community participation/involvement was assigned a very high place. It has been observed that initially, community participation was very high but interests in the schools seem to be waning, at least in some aspects. For instance, most personnel in the community who were invited to schools to give talks/lessons, expected some kind of financial remuneration at the end of it all. However when this was not forthcoming, interests waned. In the light of this, the community's participation needs to be revisited. The community needs to be sensitized to the fact that the education of their wards is much their problem as it is the government's and teachers'. They should therefore participate without expecting any compensations from the schools and should readily avail the school of any material resources that will enhance the teaching/learning processes especially in science. It is however heartening to note that in some instances community participation is very high

and has often come to the rescue of distressed schools. The PTAs and Old Boys'/Old Girls' Associations are notable community resources.

The Government could allocate funds for the science teachers to explore and exploit the environment. Government could provide means for short/long trips to places that are of significance to the teaching/learning of science; and provide finances to purchase other materials from the environment to make teaching aids. Financing field work has not seen much encouragement and much needs to be done.

From the foregoing, it might be concluded that the fore-mentioned two objectives of using the environment for science teaching have not been achieved. Teachers find it difficult to provide adequate experiences in the field as outlined in these objectives due to ignorance, laziness, but above all due to lack of finances to undertake field trips.

Space for Science Teaching

Rooms used for science teaching have many common qualities regardless of the level or the field of science. Space requirements, illumination, and heating systems as well as attractiveness are some common qualities. Here however, the discussion will centre mainly on space needed for effective science teaching. Areas to be discussed

include : area requirements per student, working space for science teachers, space for storage of apparatus and supplies (equipment), the situation as it pertains in our institutions of learning and its effects on learning and finally suggestions as to how this situation could be rectified.

Area Requirement Per Student

The teaching of science, as contained in the Educational Reforms of 1987, requires a larger area for each student than was provided for in the earlier science learning situations. The bases for this increased area are :

1. The nature of learning activities in science has been broadened to include a greater range of activities than in the past. Within this increased scope, there are various activities which in themselves require considerable freedom of movement on the part of the student.

2. There is now greater emphasis on small working groups and individual work, each of these procedures requires more space than formal classroom.

3. Science teaching now involves a greater wealth of learning materials than has been true in the past. There is a greatly extended array of apparatus, models, charts, diagrams,

projected materials, computers (as at the various Science Resource Centres), greater amounts of glassware etc. all of which require larger areas for use; and

4. Lastly, the Educational Reforms have witnessed so far greatly increased numbers of pupils/ students at all levels in our institutions, and this by itself requires an appraisal of existing room space for learning in general and science teaching/ learning in particular

In the past, determination of needed floor area of science rooms have generally been based upon a minimum of two square metres per student. Experience indicates, however, that rigid adherence to an area-per-student formula alone with little or no thought for room arrangement results in cramped and unused areas. Effective science teaching requires a minimum per-student area of about 4 square metres. This calculation does not include such accessory space as storage room, preparation room, dark rooms, etc.

Storage of Apparatus and Supplies

Separate storage rooms for scientific apparatus and supplies are desirable in all schools. Often such rooms are used also for preparing for demonstrations and laboratory work, and repair and adjustment of

apparatus. At the JSS/Primary levels, a science corner is often good enough for children's collections but room for storage of equipment and materials is still necessary.

Facilities for Demonstrations

Successful demonstrations require a satisfactory teacher's demonstration desk with necessary facilities, no matter the level. There must also be a minimum of demonstration equipment, which is in general, relatively large and simple. The demonstration desk should be high enough for students to see the demonstrated materials easily from their seats.

Room for the Science Teacher

A science teacher regularly engages in a number of activities for which space should be provided : keeping records, making plans, preparing demonstrations, repairing and creating equipment for student experimentation, conferring with students etc. as well as attending to his own professional growth through reading and other activities. There should thus be sufficient room provided as a preparation centre for the teacher. There should also be sufficient room for the teacher's desk to be somewhat separated from the desks of the students/pupils.

In our primary and JSS working space for the pupils is so small that it might be said to be non-existent. Pupils are crowded into rooms originally meant for only 46 pupils. In most cases, the rooms contain as many as double the required figure. These rooms were meant for general instruction in all fields of study endeavour and not specially or specifically designed for science teaching. At these levels, the emphasis should be on child-centred activities, where the child takes responsibility for his studies, and is given a wide range of choices in his science learning. The child needs to be mobile, but in these crowded rooms he has no chances to satisfy his burning curiosity to know more about himself and his environment. The teacher's table - that is if he has one - is so much surrounded by other pupils' tables and chairs that movement during any lesson is greatly reduced. How he teaches science is best left to him and anybody who cares to guess.

There are the lucky ones - those who happen to be housed, even though in most cases, these "houses" are more. of a death-trap than a "house" where formal education should be executed. The not -so-lucky pupils are those who find themselves sheltering under the shades of provident trees and those who lie prostrate on their bellies and look up at the teacher as he delivers his "lectures".

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effectively teach science ? Truly, it might be said science must not necessarily be learnt in the classroom, but learning both in and out of the classroom, especially in the classroom, has its psychological advantage.

It is also worthwhile to note that the scanty science materials that the Government sacrifices so much "scarce foreign exchange" to acquire for these schools, in many cases, never find daylight, nor reach the science teacher (if there is one) since they are always locked away in the headteacher's office and in the boxes in which they arrived; and at times left to decay or waste away, since there is no space to display them.

The question is "Is the Government aware of these situations"? This can be answered in the affirmative since they have policy implementors who keep them informed of what is going on in the classrooms. If this is so, is the Government just paying lip-service to teaching the child science to be an all round person, and providing the much needed manpower in science, which is very vital to the development of our dear nation ? If it is not just lip-service the Government is paying to science (and we are all inclined to think Government is very serious about the success of the Educational Reforms, especially in the field of science), then there is the need to

revisit and appraise the infrastructure situation as it exists particularly in the rural areas since WAEC does not discriminate between the lucky and less fortunate schools when questions are set in the final examinations.

The situation, as far as working space and storage facilities in the SSS is concerned is much better. As has been pointed out, for students to effectively carry our science practical work, be it project work, practical lessons, group discussions etc., a lot of space is needed. This is so because of the very nature of science. The existing laboratories in the very lucky SSSs were originally designed for 30 students. Occasionally, teachers have had to put the side benches/ equipment cupboards to "good use" due to increased numbers. However, with the take-off of the SSS programme, the number in the classrooms have more than doubled, thereby overtaking the space available for students and teachers alike to work in. In many cases, students' science working space has now been reduced to something less than one square metre.

Yet, as has been pointed out, the new science programme stresses a hands-on teaching, a method of teaching which requires the teacher abandoning the traditional method of transmitting knowledge where students act as sponges, just soaking up what the teacher passes on to

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Yet, as has been pointed out, the new science programme stresses a hands-on teaching, a method of teaching which requires the teacher abandoning the traditional method of transmitting knowledge where students act as sponges, just soaking up what the teacher passes on to

them. The generative learning model, which requires the students to generate knowledge from their own activities, underscores the teaching-learning situation in science in the Educational Reforms. Most science experiments need large space to be carried out. Sometimes, there are so many students clustered around the teacher's table, for want of space, that even demonstration exercises become a big problem to the science teacher.

In many of the new SSSs, the science equipment that has come in cannot be stored adequately; in most cases they take up precious working space in rooms designated science rooms.

It is assumed that science in the secondary school must serve two purposes at the same time (i.e. for the development of young people in the scientific aspects of their lives and for the growth of science itself) and that the schools should provide for both. Opportunities for this dual growth are possible within the usual course offerings and that as the science curricula of the future are planned, those courses that are based upon broad and developing curricula, or on the application of science, or on intensive or extensive work in a particular aspect of science, merit careful attention. The simple question that may however be asked is "Was the science programme as outlined in the Educational Reform given the careful attention in the area of working space, or was it left to take care of itself"?

If it was left to take care of itself, then it is high time the Government got informed that a lot more space is needed for effective science teaching/learning.

At the Primary /JSS level, the pavilions being erected are praiseworthy, but they are woefully inadequate. Community participation is stressed, but communities are so poor they cannot afford to be active part-takers of providing meaningful education to their wards.

In other communities, PTAs are supplementing the efforts of Government. With the Government's introduction of FCUBE (i.e. Free, Compulsory, Universal, Basic Education) in the 1997/98 academic year, the pupil population has expectedly increased dramatically. Is room space also going to be increased dramatically ? Government should re-visit this situation as space is very vital for the teaching /learning process, particularly for science.

The second cycle institutions also need a lot of room space, for it is this stage that the to-be scientists emerge. They therefore need the chance to explore and experiment. Government is already providing science resource centres, but the computers and other materials have gone to occupy very precious spaces in these laboratories. More space is needed and in this area it has been noted that various PTAs are working gallantly to help out, but

again the Government must sit down and re-address the problems of space in these institutions. The idea of de-boardenization is to allow many more students to benefit, not to de-congest these congested institutions.

The situation in the tertiary institutions is worse. Practical work in science has become a great problem since these laboratories were made to cater for about 50 students at a time. Now we have 200 to 300 students in them at a time. There is the need for stake-holders to come to the aid of the Government. There is also the much talked about cost-sharing in the universities which it is hoped will enable the government to direct much attention to providing more space for learning. All these are praise-worthy but it is still the duty of Government to provide the needed space for scientific work.

In summary, it is apparent that the agencies of Government, when they planned the implementation of the Educational Reforms of 1987, did not take into consideration the large numbers that would result, especially in a rapidly growing population as ours, and as such have literally been taken unaware as far as provision of space is concerned. They need to work and work fast to alleviate the appalling situation that seems not too far away if more space in our institutions of learning is not provided. May be re-visiting the shift

system in all its forms could be a short term measure; but there is the need to stress that teachers should be adequately motivated financially to make the educational reforms a success.

Conclusion

An attempt has been made by this paper thus far to show the state of resources for the teaching and learning of science in this country and the implications of the presence or lack of these resources for an effective science education programme. Suggestions have also been made on how to moderate the overall negative influences of the lack of resources.

Also from the foregoing, it is evident that although Government has been making spirited efforts to develop science education in this country, the overall result has been less satisfactory. Therefore much remains to be done if the country is to develop scientifically and technologically.

It is the fervent hope that the suggestions made so far would be critically examined and given the highest consideration by the appropriate authorities who are in charge of science education policy formulation and implementation.

All said and done, it must be emphasized that the most important of the science resources - the science teacher - without whom it will be

difficult for the objectives of any science education programme to be achieved, should be highly motivated with incentives of diverse kinds.

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GHANAIAN STUDENTS' IDEAS ABOUT
FORCE AND FRICTION

Otuka, J. O. E., Anamuah-Mensah J. and Thompson, A.

ABSTRACT

This study was conducted to identify the misconceptions Ghanaian Secondary School students have about force and friction.

The questionnaire was administered to 90 science and 60 non-science students. The respondents were stratified samples from the first, second and third year students of Mfantsipim Secondary School in the Central Region of Ghana.

Graphical analyses of the correct scores were used to identify the existence of and the extent to which the alternate ideas persist among the students.

The study revealed that students believe

(i)   that force implied motion and vice versa,

(ii)   that continuous motion of a body without an external force is due to the fact that force can be transferred,

(iii) that friction is force which always opposes motion. They could, however, not conceive how friction could promote any type of motion (e.g. rotation).

These misconceptions were found persisting among all the students,

irrespective or age, class or programme of study.

The paper makes recommendations for management of teaching and review of textual materials for students development of new teaching strategies and future research.

Introduction

The number of students who apply to study Physics at Ghanaian Universities has been persistently low in recent times (Crentsil, 1996). Data collected from six educationally renowned secondary schools in the Cape Coast Municipality in Central Region of Ghana, showed that the results for Physics and the other science subjects (notably biology and Chemistry) were consistently poor in almost all the schools: The results were compiled from the report of the senior secondary education terminal examinations conducted by West African Examinations Council (WAEC) in 1993.

One of the factors contributing to this trend could be poor understanding of the scientific concepts by the pupils (Nelson, 1992). Also, most students

already consider Physics to be the most difficult, most boring and hence the most disliked subject within the sciences (Nachtigall, 1995). Djangmah (1988) highlighted that, "the method used in teaching scientific (and specially Physics) concepts is not in consonance with the child's cognitive and affective development". Another factor could be attributed to the findings that students hold alternate ideas about scientific phenomenon which are taught in schools; and that these alternate views persist and often interfere with correct scientific explanations in the course of the academic studies (Pope and Gilbert 1983; Driver, 1981, Erickson, 1979; Osborne and Gilbert, 1980).

The study was conducted to investigate Ghanaian students' views about the concepts of force and friction. The study investigated, as well, the effect of such factors like, age, class and course programmes, on the views the students have about the concepts. Specifically, the study sought answers to the following questions :

i. Do Senior Secondary School (SSS) students have alternate ideas about force and friction?

ii. Do SSS students' views of force and friction differ as they move from SS1 to SS3?

iii. Do SSS students of different ages have and differ in their alternate views of force and friction ?

iv. Do SSS science and non-science students have and differ in their alternate ideas about force and friction?

v. To what extent do the science and non-science students' alternate ideas of force and friction change with progression from SS1 to SS3 classes ?

Methods of Investigation

The sample for the study was made up of 90 science students (comprising 30 each from SS1, SS2, and SS3,) and 60 non-science students (comprising 20 each from SS1, SS2 and SS3) of Mfantsipim School in the Central Region town of Cape Coast. The non-science students offer only general science as a core subject. The ages of the students ranged from 15 years to 17 years. Stratified sampling method was adopted in selecting the respondents such that it covered both the science and non-science students in all the three classes whose academic achievements were above average and below average scores. Mfantsipim is a unisex (boys only) school in the Central Region of Ghana.

Instrument

A twenty-item questionnaire was used to gather data for the study. The administration of the instrument was

followed by a clinical interview involving 10% of the respondents. The interview schedule was meant to tap the thinking process of the students on the concepts of force and friction.

Three physicists and one physics educator validated the instrument.

Data Collection

The instrument was administered by one of the writers. Each correct option was given a score of 1, and a wrong option scored 0. The frequency distribution of the scores was put in a tabular form. The percentages of the correct scores for the question items were presented graphically.

After the administration of the written questionnaire 9 out of the 90 science students and 6 out of the 60 non-science students were selected through stratified sampling. They were interviewed orally and audio-taped. The sampling for the oral interview was done to reflect equitably the thinking of either of the two groups (science and non-science) whose scores were above average, on the average and below average in the test questionnaire. The interview was also meant to identify the extent to which the students' thinking did reflect their self-reporting ideas and also other ideas or reasons not covered by the questionnaire.

In order to make the analysis and the discussion of the results clearer the items of the instrument are reproduced below together with the responses from the oral interview.

Questionnaire (Section ii Of Instrument)

1. Which reason explains why a stationary object remains in its state of rest on rough horizontal floor ?

   A. No force acts on it
   B. Weight of the box
   *C No unbalanced force acts on it
   D. It's weight prevents change of position

2. If a boy pushes a box along a horizontal rough floor, which force is he trying to overcome?

   *A Friction
   B. Weight of the box
   C. Perpendicular force from the floor
   D. The boy's own weight

3. According to Newton's first law of motion, if a body in linear motion does not change its direction or motion, then we can explain that :
   A. There is/are no forces on the body
   B. The path is smooth
   C. The forces acting are inside the body
   *D. There is no unbalanced force on the body.

4. What will cause a body moving linearly with constant velocity to change its direction or motion?

    A. If more forces act on it
    B. If the forces acting are removed
    *C. If an unbalanced force acts on it
    D. If the path is made rough.

5. Which statement explains why a ball continues to move long after the kick?

    A. Because the ball is round
    B. Because no force continues to act on the ball
    C. The kicking force continues to act inside the ball
    *D. The kicking force is converted to momentum

6. Which other force helps a student who pushes a book along rough horizontal surface of a table?

    A. Force from the tables
    B. Force of gravity
    C. High Friction force
    *D. No force

7. A spherical solid ball at rest is allowed to move freely on a rough inclined plane. What force will cause the motion

    A. Perpendicular force from the plane surface
    B. Inertia
    C. Friction
    *D. Force of gravity

8. After the fall of the ball (in question 7) from the inclined plane the ball continues to move freely along the horizontal floor. What force will act to stop the ball eventually?

    A. Force of gravity
    B. Perpendicular force from the floor
    *C. Friction from the floor
    D No force, but it will stop by itself

9. Which other force helps a student who rolls a drum of oil along a rough horizontal floor?

    *A Friction
    B. The drum's weight
    C. Force of gravity
    D. No Force

10. Which force causes the continuous motion of a boy riding on a bicycle when he stops pedalling for a moment?

    A. Friction
    B. Force of gravity
    *C. No force, but gained momentum
    D. Force transferred from the boy's legs.

N.B.: * Indicate the correct option to each question.

Results

Throughout the study very low scores were consistently recorded by the students on questions (1), (6), (9) and

(10) of the instrument. Hence, the discussion of the results will focus on the aforementioned questions to which majority of the student s gave wrong responses indicating some misconceptions.

Research Question One: **Do Senior Secondary School (SSS) students have alternative idea about force and friction?**

change it. This is true, however, 10.7% of the students thought that friction is the force preventing the change; while another 12.0% of the respondents also thought that the weight of the object is rather causing the body to remain at rest. Since the body does not lie on inclined plane, friction could not act to prevent any change of position.

FIG. 1
Results of Survey of Ideas Held by all the Students using the Instrument
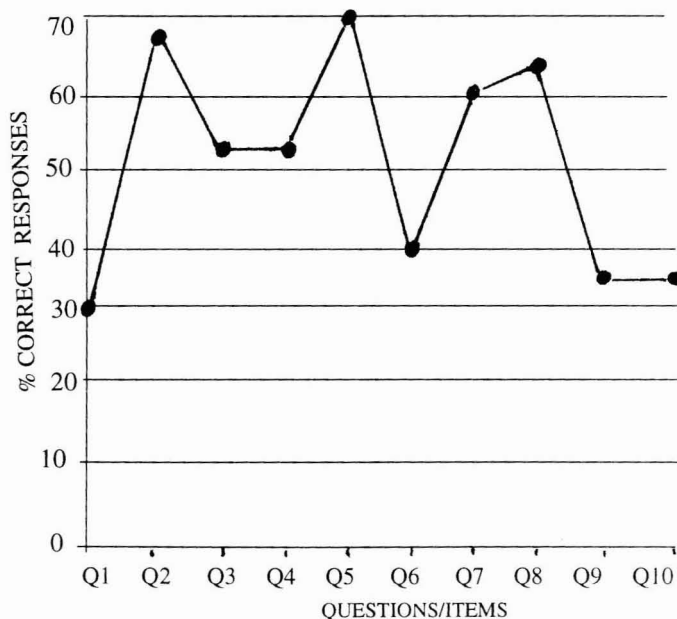
Only 30.0% of the total respondents chose the correct response to question (1). The students' thinking is that an object at rest will remain stationary unless an unbalanced force acts to

On the other hand, as much as 47.3% of the respondents argued that since the body remained at rest then no force, at all, is acting on it.

The latter response of the students exposes their thinking that force always implies motion and vice-versa. Again, only 40.0% of the students gave correct response to question (6). They reasoned, rightly that apart from the effort force, no other force can act to help the pushing of the book. But, on the other hand, 39.3% of the students thought, rather, that the friction force would aid the sliding motion. It is right for the students perhaps to think that low friction cannot resist much linear or sliding motion. Hence whenever friction is low enough the sliding motion would still be far easier. But, on the other hand, however low the friction may be it could not act to aid the sliding motion. Secondly the surface of the table in the question was said to be rough. This indicates that the friction is not so low as the students might be thinking of.

On question (9) only 35.3% of the students chose the correct response. Equally, 30.7% of the students thought that no force would act to aid the rolling motion. This response indicates that majority of the students could not realise that rolling is motion by rotation and that in rotational motion a torque ($T = Ed$) is responsible. In this type of motion the floor acts as the fixed frame of reference about which the cylindrical drum rotates.
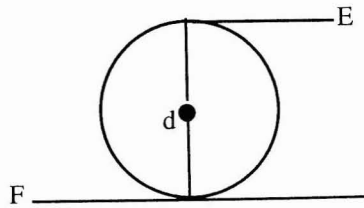
Consequently, the friction **F** force along the rough floor acts to prevent slipping of the drum, thus promoting rotational motion.

Finally, on question (10) 35.3% of the students had the correct idea. This group of students had the right conception that the continuous motion of the bicycle, after pedalling momentarily ceased, was due to the initially gained momentum. On the other hand, as much as 44.0% of the students chose the response that the continuous motion of the bicycle was due to the fact that the initial pedalling force was transferred from the boy's legs to, probably, the wheels of the bicycle. The students' thinking is that a force is always responsible for motion; they could not conceive the idea of motion without force (Driver, 1983).

Research Question Two : Do SSS students of different classes have and differ in their alternative views of force and friction?

The data were analyzed again to answer the above question and to find out if alternate views held were due to

students belonging to different classes or year groups (i.e. SS1, SS2 or SS3). The analysis indicated that all students from the three classes held similar misconceptions about force and friction.

Figure 2 also illustrates the patterns of the correct responses for questions of the instrument. On question (1) 36.0% of the SS1 scored correctly; only 26.0% of the SS2 scored correctly and 28.0% of the SS3 students also had correct views.

students gave the correct response. Similarly, on question (9), 38.0% of the SS1 chose the correct response; 42.0% of the SS2 also gave the correct option while only 26.0% of the SS3 students gave the correct responses. Finally, while 36.0% of the SS1 chose the correct options to question (10), and 40.0% of the SS2 scored correctly, only 30.0% of the SS3 students indicated the correct view. Fig. 2, thus portrays very low correct scores for the same questions

FIG 2.
Results of Survey of Ideas Held by Students
of Different Year Groups
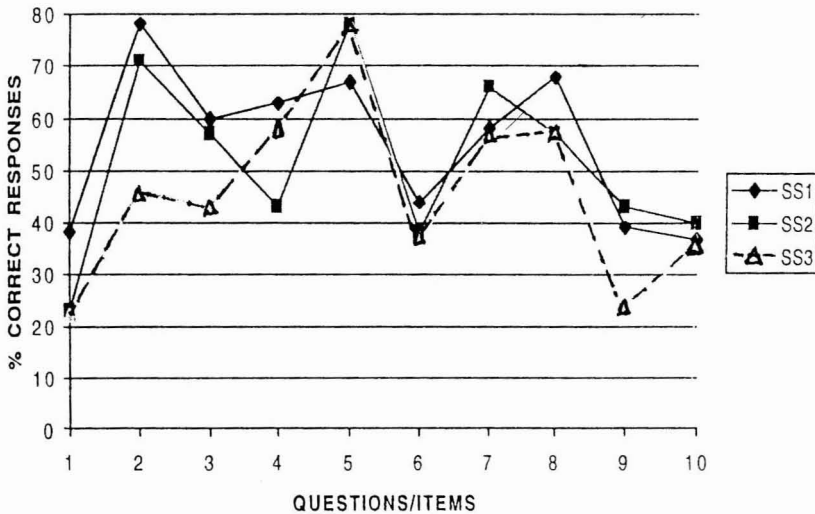
On question (6) while 48.0% of the SS1 had the correct response, only 36.0% each of the SS2 and SS3

by all the classes of students. The low scores indicate that most of the students had wrong views about force

and friction. Again, the similarity of the variation of the scores show that the alternate views held by the students in each class did not differ.

Research Question Three : Do SSS students of different ages have and differ in their alternate views of force and friction?

The study went further to investigate whether the alternate views held by the students were due to their age differences. Analysis of the data indicated that all the students of ages 15, 16 and 17 held the same type of misconceptions as discussed earlier. Low percentages of correct

Figure 3 illustrates the pattern of the scores by the students on the questions. Correct scores recorded for question (1) were 53.8% by the 15 year old , 25.0% by the 16 year old and 29.0% by the 17 year old students. On question (6), correct scores were recorded by 16.5% of the 15 year old, 38.6% of the 16 year old and 37.6% of the 17 year old students. Again on question (9), 38.5% of the 15 year old scored correctly; 43.2% of the 16 year old scored correctly; while 31.2% of the 17 year old students also chose correct options. And finally , on question (10), correct

FIG. 3
Results of Survey of Ideas Held by Students of Different year Groups
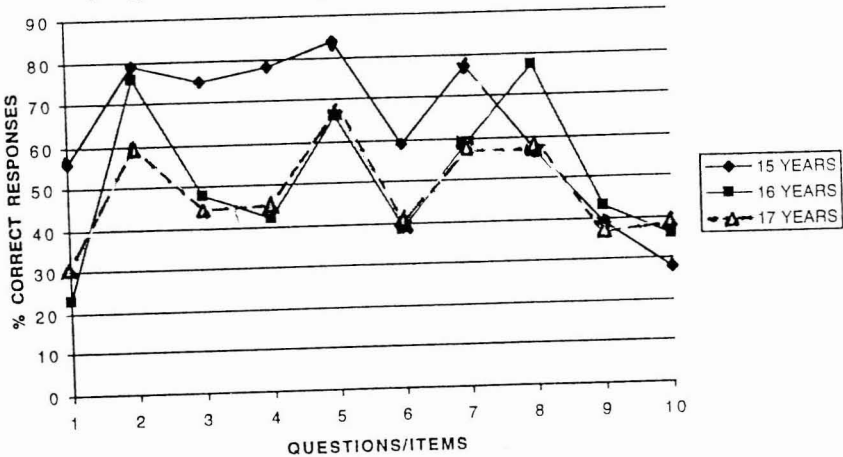
responses were recorded for all the three age groups and on the same questions (1), (6), (9) and (10) of the instrument..

scores were obtained from 30.7% of the 15 year old, 34.0% of the 16 year old and 36.5% of the 17 year old students. The similarity of the

Patterns and the range of the correct responses indicate that misconceptions about force and friction exist among the SSS students, irrespective of their age differences; and also that the alternate views held by the students do not differ despite age differences.

Research Question Four :   Do science and non-science students have and differ in their alternate views about force and friction?

Two groups of students with different course programmes were sampled. One group study science (with elective physics) and the other representing the non-science group study only some elementary physics in a core science course. All the alternate conceptions found in the previous investigations were also identified among the students in this analysis and in similar proportions.

FIG 4
Results of Survey of ideas Held by Science and Non-Science Students
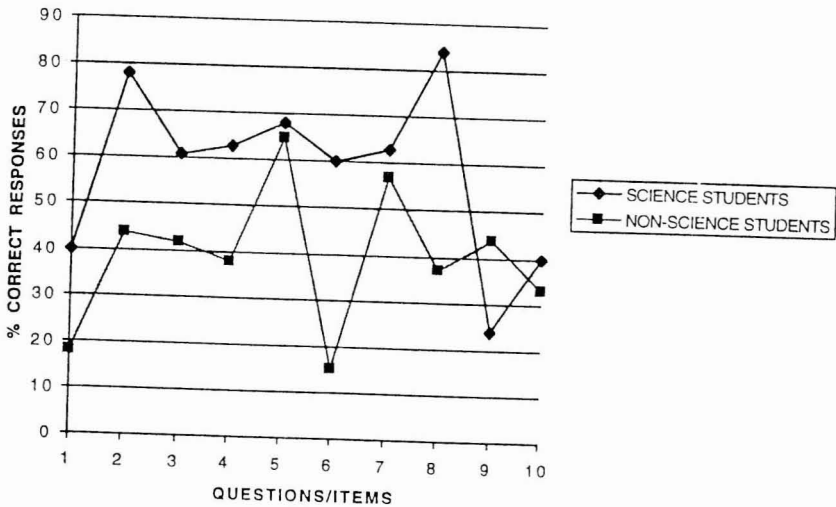
Further analysis was undertaken to investigate how the course programmes of the students would affect their alternate views about force and friction.

Analysis of the response made by students on the questions showed that 38.9% of the science and 16.7% of the non-science students respectively scored correctly on question (1). On

question (6), 60.0% of the science and 10.0% of the non-science students gave correct responses. Also while 26.7% of the science scored correctly on question (9), 48.3% of the non-science students had correct view. Finally on question (10) 38.9% of the science had correct view while 30.0% of the non-science students had correct response. The relatively low scores by both groups of students on question (1), (6), (9) and 10) indicate that the science as well as the non-science students have misconceptions about force and friction. Furthermore, the similarity of the score patterns (see Fig .4) indicates that the misconceptions held by both groups did not differ. However, the science students seem to have correct views on the concepts than the non-science.

***Research Question Five*:   To what extent do science and non-science students' alternate ideas of force and friction change with academic progression (i.e. from SS1 to SS3 Classes?**

The data were further subjected to another analysis to ascertain the extent to which the alternate views held by either the science or the non-science students persisted or changed as they progressed along the academic ladder. The results of the analysis revealed no meaningful difference for the science students at SS1, SS2 and SS3; nor for the non-science students also at SS1, SS2 and SS3 (see fig.5a and 5b respectively).   Low percentages of correct scores were still recorded on the same questions (1), (6), (9) and (10) for either group of students in the three course years.

FIG 5a
Results of Survey of ideas Held by Science
Students in different Year Groups
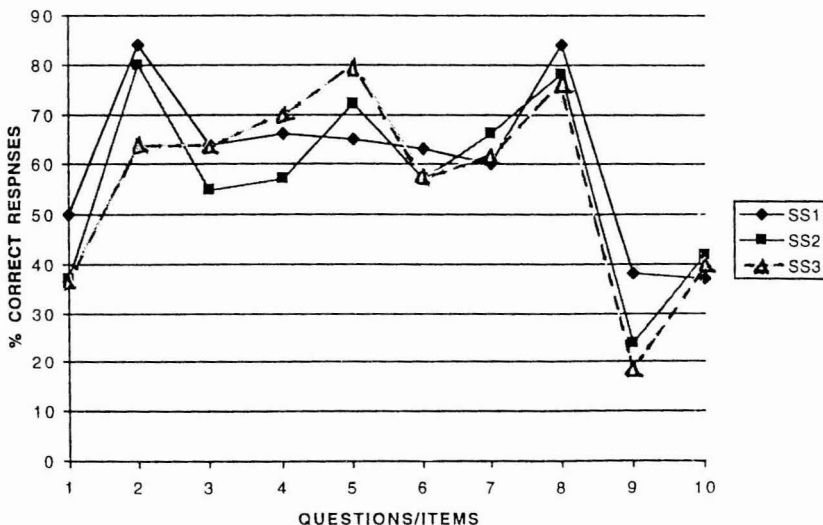
The similarity of score patterns has revealed that the alternate notions held by both groups of students did not change but rather persisted throughout the three academic years, despite repeated use of concepts throughout the period.

Question 1: Could you state Newton's first law of motion?

A. *Responses* : By Above-Average students

FIG 5b
Results of Survey of ideas Held by Science Students in different Year Groups
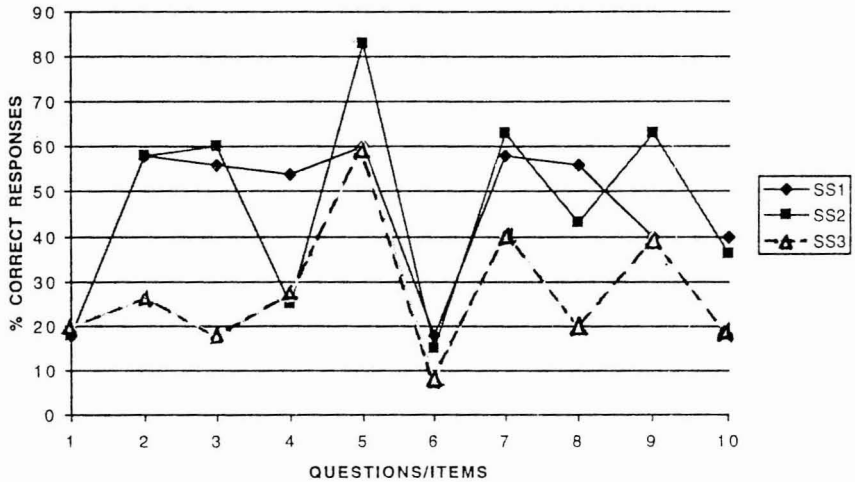
The Interview Schedule

The following is a sample of the edited version of the interview schedule. S1, S2 and S3 refer to the three science students, N-S1, and N-S2 refer to the two non-science students.

S1, S2 and S3 : A body continues in its state of rest or uniform motion unless compelled by an external force to change.

N-S1, N-S2: A body continues to

be in motion or in a state of rest unless a force is applied to it.

B. *Responses* : By Average Students

S1, S2 and S3: I cannot remember well, but it says when a body is at rest or in motion there will be a force to change the motion.

N-S1, N-S2 : A body continues to be in motion or state of rest unless a force is applied.

C. *Responses:* By Below Average Students

S1, S2 and S3 : I cannot remember

N-S1, N-S2:   No idea

Question 2: Does a body at rest have a force acting on it?

A. *Responses* : By Above-Average Students

S1, S2 and S3: Yes, it does have.

N-S1, N-S2   : No force is acting

B. *Responses:* By Average Student

S1, S2 and S3: Yes, there are forces acting.

N-S1   : No force is acting .

N-S2   : Yes, Force acts on it.

C. *Responses:* By Below-Average Students

S1, S2 and S3:   No force acts.

N-S1 and N-S2:   No Forces act.

Question 3 : Explain why the body at rest does not move.

A. *Responses:* By Above-Average Students

S1:   The wood opposes it.

S2 and S3:   The forces balance.

N-S1 and N-S2: It is opposed by friction

B. *Responses:* By Average Students

S1:   Apart from inertia there is no other force.

S2 and S3:   External forces act to make it rest.

N-S1 and N-S2: It cannot move if there is friction.

C. *Responses:* By below-Average Students

S1, S2 and S3 : Because friction and gravity oppose it.

N-S1, NS2: Because no force is acting.

Question 4: Explain why a kicked ball continues to move even after the kicking force is no more acting.

A.   *Responses:* By above-Average
            Students

S1, S2, and S3: It has gained
            momentum which
            makes it continue.

N-S1, N-S2: The continuous motion
            is caused by the force
            which has become
            transferred.

B. *Responses* : By   Average Students

S1 and S2:   The force continues to
            move with it.

S3:   If the kicking is
            strong then the
            motion continues
            until it   finishes.

N-S1, N-S2: The Force goes with the
            ball until it reduces.

C. *Responses* : By Below-Average
            Students

S1, S2:   The continuous motion
            depends on whether
            the ball is light or not.

S3:   The kicking force goes
            with the ball.

N-S1:   The continuous motion
            is caused by friction.

N-S2:   The continuous motion
            is due to the fact that
            the kicking force is
            strong.

Question 5: What does friction do?

A   *Responses:* By Above-Average
            Students

S1, S2 and S3: It opposes motion.

N-S1 and N-S2: It opposes motion.

B. *Responses* : By Average Students

S1. S2 and S3: It causes wear and
            tear of shoes.

N-S1 and N-S2: It acts to stop motion

C. *Responses:*   By Below Average
            Students

S1, S2 and S3: It opposes motion.

N-S1, and N-S2: It opposes motion.

Question 6: Can Friction be useful?
            Give instance where
            friction is useful.

A. *Responses*: By Above Average
            Students

S1, S2 and S3: Yes. Useful in walking.

N-S1 and N-S2: Yes. Useful in
            walking.

B. *Responses:* By Average students

S1, S2 and S3 : Yes.Useful in walking.

N-S1, and N-S2: Yes. It helps us to walk.

C. Responses ; By Below Average Students

S1, S2 and S3: Yes. It is good for walking.

N-S1 and N-S2: Yes. It is good in walking.

QUESTION 7 : Give another instance where friction is useful.

A. *Responses* : By Above Average Students

S1 and S2: Writing on the board.
S3: Grinding of knives.

N-S1 and N-S2: It causes wear.

B. *Responses*: By Average Students

S1 and S2 : It wears shoes.

S3: It is useful in fixing of nails in wood

N-S1 and N-S2: No idea.

C. *Responses*: By Below Average Students

S1 and S2: No idea.

S3 : Useful in riding of bicycles .

N-S1 and N-S2: No idea.

Discussion

The study revealed the existence of some alternate views about force and friction among the senior secondary schools. This confirms the findings in similar studies conducted elsewhere (Pope and Gilbert, 1983; Driver, 1989; Erickson, 1979; Ivowi, 1984).

The low percentages of correct response to question (1) show that most students think wrongly that force always causes motion. In other words most students have the notion that motion always implies an external force causing it or vice versa. This view of students has also been reported in similar studies by Watts and Zylberstajn (1981), Clement (1982) and McCloskey (1983). This notion also made the student choose incorrect responses to explain that if a body continues to move without any visible or applied external force then the initial impelling force must have been transferred from one system to another. This is in agreement with what Driver (1983) identified in a similar study.

The students' misconception could stem from the wrong or the literal interpretation of Newton's first and second laws of motion that force is always responsible for motion. This

idea or the interpretation would be acceptable if only they are thinking of force causing change of motion or state of rest. Furthermore, external forces acting on a body do not, necessarily, cause **change** in the state of rest or motion unless when they do not balance. Only a resulting unbalanced force can cause change in the state of rest or motion.

In the interview conducted two weeks after the test, it was observed that none of the students could make complete statement of Newton's first law of motion. The students had forgotten the correct statement of the law. They did not comprehend the law but rather committed it to memory, hence, making it easy to forget. On the other hand, only a few of the students could guess that forces could still act on a body at rest. However, they were not able to apply the law to explain the question of why a body at rest could still have external forces acting and yet not move. Some students in an attempt to explain that situation mentioned friction as being responsible for keeping the body at rest.

On the explanation of the continuous motion of a body without visible external force, very few of the science students in the higher achiever group could think of initially gained momentum as the cause. The rest indicated that the

original impelling force was transferred to the body; that it continued with it until it finished.

Again, the low percentage scores recorded on questions (6) and (9) indicated that SS students hold some alternate view of friction. Students, however, scored highly on other questions on the nature of friction. This demonstrates that students know correctly that friction often acts to oppose motion. They could not visualize how on the other hand, friction could help to promote motion, apart from walking which is always mentioned in textbooks. The students' thinking was limited to only linear motion, even though they have learned of other types of motion (e.g. rotational, oscillatory, circular, etc.). They thus, failed to recognize the rolling motion in question (9) as rotational; and that friction provides for the torque responsible for this motion.

In the oral interview, again, all the students stated correctly that friction opposes motion. They all mentioned walking as an example of the useful application of friction. Their responses indicated only what they have exactly read in books or been taught. Most of them could not state any other advantages of friction. It is likely, their wrong thinking stems from the misconception of the general statement that "friction opposes motion". This statement does not

declare which type of motion (ie. sliding), hence the naive ideas.

Analysis of the data from the students in SS1, SS2, and SS3 showed that similar misconceptions for force and friction exist among them. This result confirms those reported by Osbone and Gilbert (1980) and Nelson (1992) that misconceptions are prevalent among students at all academic levels of education.

The data collected from the students of ages 15, 16 and 17 years (or above) indicated that SSS students of all ages hold misconceptions which are not different. This finding is also consistent with those of Watts and Zylberstajn (1981), Clement (1982) and McCloskey (1983).

It was further observed that both science and non-science students have similar misconceptions about force and friction. This observation was quite contrary to expectation. Science students are expected to have better views of the concepts since they have greater opportunity to encounter scientific instances and phenomena involving the concepts. The expectation is that science students' consistent encounter with the concepts in their studies would help reduce or eliminate, to a large extent, some of the wrong ideas previously held. Nelson (1992) studied students ideas about inertia and discovered similar performance

by science and non-science students. He therefore questioned the influence of our traditional teaching methods on concept development.

Further, detailed analysis revealed that the misconceptions prevalent among either the science or non-science students persisted along the academic years and proved resistant to change as reported, also, by Terrance and Wytze (1991).

On the whole, the study has revealed that SSS students have some alternate views about force and friction. The results of the interview did not reflect strongly, what was obtained using the questionnaire. This situation could be explained by the fact that the students might have had time to consult textbooks or discuss among themselves after the administration of the test.

Implication For Instructional Management

One of the important objectives of studying physics is that students would develop the ability to comprehend and relate general physics principles to everyday, natural and environmental phenomena. The results of this investigation show that many students emerge from classroom instruction in mechanics unable to associate the laws of force and friction with the change of state of

rest or motion of objects they encounter in everyday life. This situation has been identified in this study as due to some misconceptions held by the students.

The possible causes of these misconceptions among the students are traceable to some statements or definitions in textbooks and also the misconceptions held by some teachers. From many of the accredited textbooks on the market, Newton's first law of motion states, inter alia, "every body continues in its state of rest or uniform motion in straight line unless compelled by an external force to change". This statement sounds a little ambiguous. It can be interpreted to mean that a body at rest will change its position only when an external force acts; or that, if the body is in uniform motion along a straight path, it is only an external force that can change the motion. This notion, if correct, presupposes that there could be no external force already acting before the change. The latter interpretation would be true only in an absolute sense; that is, it is true only in a vacuum. But in the normal physical condition there can be no situation where no external force will be acting on a body in equilibrium. For instance, a body hanging on a suspended string will have on it external forces (the tension and gravity) acting and yet be in a state of rest. The forces must balance in this case.

Hence, that statement of the law needs to be restated in a more non-ambiguous way. This can better be done by introducing the word "unbalanced" to qualify the external force needed for the change of equilibrium state. The law could rightly be stated as:

"Every body remains in its state of rest or uniform motion in a straight line unless compelled by an external unbalanced force to change".

It is worthy to remark that some authors have attempted restating the law by introducing the concept of a "net" or "resultant" force. But a *net* or *resultant* force can be zero (or not zero); and this will, certainly, not help in the elimination of the ambiguity. An unbalanced force can never be zero to bring about any ambiguity. The introduction of this term (unbalanced) would imply that if all previously existing external forces could not cause any change in the equilibrium of a body then they balanced each other. On the other hand, one could use the term 'non-zero' resultant force in place of the concept, unbalanced (if this sounds colloquial) in the statement of the law.

On the other hand, some teachers have their own erroneous ideas about the concepts to be taught. Envisaging the difficulty in explaining facts they resort to the lecture method of teaching. They, thus, give raw scientific information by dictating notes without giving the students

opportunities to observe, experiment or even read and think to discuss those facts (Mux and Shu, 1992). The teachers often, also, adopt the above inappropriate methodology, because of the (seemingly) overloaded curriculum or the heavy teaching workload. The teacher's problem may also be due to the type of terminal examination conducted by the external agency, like WAEC (Ivowi, 1984). The exams require more of declarative knowledge, i.e. description of events than analytical evidence of actual understanding.

It is suggested that a more realistic curriculum and terminal examinations emphasizing more the cognitive development and operational knowledge by the student would be developed and reviewed periodically. This study has revealed the need for educational managers at the various levels, to be organizing regular seminars and in-service programmes for science teachers to prepare them, among other things, for identifying and correcting misconceptions students often have about scientific facts. Again, in-service courses should aim at identifying the alternate views of teachers themselves about some basic physics concepts and also the procedures to remedy any such erroneous views. With their awareness of the holdings of alternate conceptions among students the teachers will, in turn, help students out of their misconceptions.

Conclusion

The findings of this study show that misconceptions about concepts of force and friction abound among SSS students in Ghanaian Schools. The study also showed that the misconceptions are similar among the students of all ages and classes irrespective of the type of course programme embarked upon; again, that the misconceptions persist and remain resistant to change. This persistence is evidence by the same misconceptions being held by all the classes (SS1 -SS3). It is expected that senior class members would exhibit better understanding after repeated use of the concepts. But this was not so.

On the basis of these findings it is envisaged that improvement of the inadequacies in human and material resource development would be addressed through effective pre-service teacher-education programmes and consistent in-service courses. The study further recommends the training of facilitators to develop and use hands-on-experiments and demonstrations (using simple local materials or exemplars) to help change the naive conceptual thinking of students to a more scientific understanding of the concepts.

This study has revealed the need for educational managers at the various

levels, to be organizing regular seminars and in-service programmes for science teachers to prepare them, among other things, for identifying and correcting misconceptions students often have about scienctific facts.

The study can be adapted to identify the gender-impact of the alternate conceptions of the terms; and also the use of parametric statistical methods to test the hypothesis.

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NATIONAL EXAMINATIONS IN CENTRALIZED EDUCATIONAL SYSTEMS: A BLESSING OR A DIPLOMA DISEASE ? - A CASE STUDY OF THE NIGERIAN EXPERIENCE

S. A . OLORUNDARE

ABSTRACT

There is no denying the fact that examinations have been a much discussed topic within educational spheres all over the world and, especially in countries with centralized systems of education. In most countries of the world, school examinations have been known to become a major means of social mobility, prestige and promotion. Besides, examinations affect socio-economic structures through the application of the criteria selection. This is so because, success in examinations usually determines an individual's entry into higher education and thus to professional posts. Consequently, a situation has evolved in which nation-wide examinations have been seen by some as a good educational enterprise (a blessing) whereas others have termed them as breeders of an educational diploma disease. An attempt has been made in this paper to examine the arguments that surround the efficacies or demerits of national examinations, with particular reference to the experience of Nigeria in the area of secondary education. The evolution, characteristics and operation of national examinations as practiced in Nigeria are discussed, and arguments for

any viewpoint one may hold as to the effectiveness of national examinations, it would be better to utilize them while cautiously avoiding any complete dependence on them.

Evolution of National Examinations in Nigeria

Laws requiring paper and pencil test of elementary school pupils had been passed as far back as 1887 under the Education Ordinance of Nigeria. Since that time, one form of examination or the other had been conducted for pupils of elementary schools; so that, by 1916, it became mandatory for elementary school leavers seeking admission to Government Secondary Schools to pass (with high grades) the Standard VII Certificate Examination (WAEC) 1966). These examinations were conducted by the Overseas Local Examinations Syndicate of the Universities of Cambridge and London (U.K.) and continued until 1948 when the West African Departments of Education took over

school exams in the then British Territories of West Africa (Ghana, Gambia, Sierra-Leone, Nigeria and later Liberia).

By 1955, the West African Examinations Council (WAEC) had established a single international examination system for secondary schools in countries previously mentioned and, this has continued to date. Under this system, any secondary school student would be deemed· to have successfully completed his secondary education if he passed the West African School Certificate Examination -WASCE or Senior School Certificate Examination, SSCE as it is being referred to recently (WAEC, 1967; ABUBAKAR, 1970). Thus, the WASCE gradually became a yardstick for the determination of the type of job, career or higher education that a student would get into after graduating from the high school. This situation led schools and parents to place more empasis on passing the WASCE with excellent grades rather than the acquisition of relevant knowledge and development of appropriate abilities and skills. It is not surprising therefore, that this National Examination and the Certificate or Diploma it offers, have become the leading determinants of teaching procedure, course of study and the future careers of students in Nigerian Secondary Schools (Fafunwa, 1969; Nwana, 1980).

WAEC and The Practice of National Examination in Nigeria

The West African Examinations Council (WAEC) is a large autonomous and dynamic body that has wide powers to conduct examinations for elementary and secondary school graduates in the countries it serves. It is comprised of about 60 members, some of whom are nominated by the national committees of the council in the countries it serves. The universities of Cambridge and London (U.K.) also have one representative of teacher organizations, universities, ministries of education, civil service, and commercial interests (FGN, 1967; WAEC, 1966; 1984). The council conducts examinations either on its own authority or on behalf of other examining bodies. For example, national and /or international examinations conducted by the council include: middle school leaving certificate examination; entrance examination to secondary schools; entrance examinations to teacher training colleges, civil service competitive examinations and, finally examinations for teacher training colleges. Funding for the activities of the WAEC are provided mainly by the participating governments although some notable external organizations have made significant financial contributions. These include: The British Council, Ford Foundation (USA), United

States Agency for International Development (USAID), Educational Testing Service (ETS), New Jersey, and the University of Chicago. These overseas agencies and institutions had at one time or the other provided the WAEC with a continuous source of technical and consulting services (WAEC, 1966; 1970; 1984; 1994).

The School Certificate Examination (i.e, WASCE) is taken at the end of the secondary school education and, performance in it usually determines whether or not a student receives a certificate/diploma. Moreover, the type of diploma received has always been a major determinant of whether the student furthers his/her education or gets a "good" paying job. The diploma was usually graded in an ascending order of: fail, GCE grade III grade II, or Grade I. In the last few years however, this diploma grading system has ceased to be used in Nigeria to classify high school graduates although, the council still retains subject grading (WAEC, 1984; 1985). Thus, passing the WASCE with a high grade level of achievement is extremely important and this has become the noble goal of students, teachers, and schools alike (Black, 1980; Akanbi, 1996). For example, if a student performed below the level of a grade II in the examination, it is certain that he would find it difficult to further his education, particularly up to the University level. Gradually therefore

this national examination has come to determine the course of study, classroom teaching procedures, and the future careers of the secondary school graduates. The examinations conducted by the Council are in the form of essays, objective type questions, practicals in science subjects and orals in French and English Languages. This system of examination (and its accompanying syllabus) is so structured and centrally controlled that the WAEC has become an unrivalled dominant testing agency in the country, particularly at the secondary school level. The same argument could be made for other West African Countries which have similar dealings with the Council (Nicol. 1971; Oyego, 1985). Despite the fading away of the diploma grading system by the Council, institutions of higher learning and employers still evaluate secondary school graduates' examination results by aggregating their subject grades - a system that has no practical significant difference from the previous system.

National examinations as practiced in Nigeria have generated a great deal of unethical practices and unfair means of passing the WASCE in order to get the diploma so much so that teachers, pupils, examiners, parents and ministry of education officials have started loosing confidence in its effectiveness and reliability. These practices reached a climax during

Merits of National Examinations

A special prestige is usually accorded to high performance in national examinations such as the WASCE. Candidates who perform very well do not usually find it difficult to either secure well paying jobs or to proceed to institutions of higher learning through which they could qualify for their desired professions. Because of the seeming importance of this examinations, there are usually concerted efforts by secondary school candidates to pass it with very good grades. School authorities also put in all relevant resources and preparations to ensure that their students perform creditably well in the examinations. After all, good performance by any school enhances its funding, recognition and patronage by the government. Performance in the national examinations results in the establishment of reliable yardstick for comparative merit of the different institutions. The competition created by such performance, also helps in the development of incentives for better teaching and learning in the various schools (khan, 1969). Ralph Tyler, one of the advocates of national systems of examinations, has succinctly argued that these examinations are meant

> to assess the educational progress of large population in order to provide the public with dependable information to help in the understanding of educational problems, needs; to guide in efforts to develop sound public policy regarding education. This type of assessment is not focused upon individual students ... but it furnishes overall information about the educational attainment of people (Tyler, 1966, p. 15).

Furthermore, Lindgreen (1973) cited the concept of accountability as the major reason for a system of national examination because, according to him "whenever we spend money, we are likely to be concerned about getting our money's worth, i.e., to be sure that input is equal to output." (p.342). In an appropriate reaction to the growing public discontent with the falling standards in U.S. schools during the Sputnik era, Bestor (1958) contended that the establishment of a nation-wide system of examinations was well overdue. According to him such a system would "test, by a common standard, the results of the operations of our separate state school systems" (p. 71). He was strongly of the view that every progressive nation must need to establish a fair, impartial and unbiased audit of her schools. He further cited the prevailing high standards of education obtained in

countries such as Japan, Britain, West Germany, France and the former USSR to have been possible due to the rigorous examination system their secondary school students go through before graduation. The absence of a national examination and a complete reliance on internal examinations have been termed "anti-development" for a number of reasons: internal examinations tend to lead to indiscreet comparisons of students; thousands of private candidates are usually left unattended to and teachers could yield to local pressures. In the latter case, grading standards could vary from school to school and thus be void of a uniform significance throughout the country concerned. Some educators have also contended that, if teachers are given an entire freedom to evaluate and classify their own students for graduation purposes, they may tend to be lax in covering the prescribed syllabus or over-compromise on standards. It is therefore argued that a system of national examination is needed to maintain a uniform standard of efficiency in all institutions and thereby institute a healthy competition among institutions as well as among graduating students. In addition, very few (if ever there is one) institutions of higher learning are said to rely completely on individual schools' internal assessment for admission purposes (Neill, 1978; Mitzel, 1982; Torsten, 1983; Obielodan, 1993).

Demerits of National Examination

Antagonists of national examinations are of the agreement that a national examination is one of the most unsatisfactory features of secondary education, as well as being a major institutional barrier to higher learning. They argued that these examinations obstruct curriculum revisions due to their accompanying prescribed syllabus, textbooks, and the centrally prepared external examinations which stifle teacher and college initiatives and experimentation (Steino, 1981; Ahmed, 1985; Akanbi, 1996). It is also the view of many educators that national examinations do more harm that good by encouraging rote memory of facts for the primary purpose of passing a diploma exam. In the case of Nigeria, critics of the WAEC contend that the undue prestige accorded the examining council had resulted in the examination determining the curriculum rather than the reverse being the case (Fafunwa, 1969; Black, 1980; Nwachukwu, 1986).

Perhaps, one of the harshest criticisms of a system of national assessment came from John Ryor, a former president of the National Education Association (USA). He remarked

> Tests of this kind don't serve students, parents or teachers. They do not measure

what is being taught and what is happening to our students. They ought to be dispensed with, once and for all (The Chronicle, Sept. 6, 1977, p. 11)

Characteristics of a good examination are that it should be valid, reliable, easy to mark and easy to score. It should also motivate pupils and teachers to work more effectively. Judged against these criteria, critics argue that national examinations possess grievous limitations that should disqualify them from being used to grade, classify and select students. These limitations include :

(i) being easy to mark but difficult to score.

(ii) having low validity — few questions are usually asked on the courses of study and such questions usually measure only knowledge of facts. Attitudes, applications and appreciation are often neglected or relegated to the background.

Furthermore, it is often claimed that the performance and behaviour of students' stay in school are not usually taken into consideration when determining the final examination results and award of diplomas. Thus, due to an overemphasis on students' grades, these examinations have been characterized by cheating, undesirable conventions and several unethical practices (Holmes & Lauwery, 1969). There is no doubt that the experience of Nigeria has borne witness to such features (Ojibara, 1998).

Some other cited demerits of national examinations are that: they dominate curriculum and instruction and therefore hinder curriculum improvement; they lack direct and personal contact with students and hence make impossible a comprehensive assessment of their achievements; they are expensive and time consuming; and they make students indifferent to their lectures and thus eventually become slack in their studies since they could easily obtain "pass" marks. Consequently, students study for the purpose of gaining success in examinations rather than for the acquisition of relevant knowledge, understanding and skills.

A Blessing or a Disease ?

Systems of national examinations are not peculiar to Nigeria. Similar practices are in operation in many European countries, Japan, the then USSR, former British and French colonies of Africa and Asia. The British Grammar Schools' GCE/CSE diploma, the French Lycees baccalaureat, German's abitur, and India's Schools Certificate are a few examples (McFadden, 1981; Torstein,

1967, 1983). Only in the U.S.A. (except the State of New York) has the selection function of national examination been called into question. Strictly, selection does not play a major role at secondary or undergraduate levels in the U.S.A. although it is interesting to note that more and more universities (in the U.S.) have in the recent past, been placing greater emphasis on high school students' scores in a nationally administered standardized Scholastic Achievement Test (SAT)).

Whichever system of evaluation is adopted, one thing must not be over-looked: it is not possible to dispense with a system of evaluation of scholastic achievement of children which enjoys public confidence and prestige. In spite of the widespread criticisms regarding the effects of national examinations on the educational system (such as the case of Nigeria), the problem of finding substitute arrangement which would be practicable and well-suited to the prevailing conditions in such a country continues to be a complicated one. Viable alternatives are yet to be developed and implemented with an appropriate degree of success.

Whatever their shortcomings are, the importance of public examinations should not be underestimated for several reasons. Firstly, they have been helpful in the maintenance of the standard of education in the countries in which they are in operation. This has been achieved by using such examinations to set levels of proficiencies that are to be achieved by all students in order to qualify for the certificate or diploma. Without such a system, standards are liable to deterioration at any level. Seen in this context therefore, these examinations are actually blessings and not educational curses or diseases! Secondly, each institution has its own quality of education and accordingly, it will be unfair to compare students on the basis of institutional marks alone. Public examinations such as the WASCE provide a basis for the comparison of students by giving one common examination to all. Thirdly, the national examining bodies can furnish a model of efficient testing since they are in a better position to afford expert service than any individual school. In Nigeria for example, most of the Council's examiners are univeristy professors/ lecturers or highly experienced college or secondary school teachers. Finally, national examinations are supposed to give an impartial assessment of students. This is possible since no personal elements enter into the exams - the examiner does not know the examinee and vice versa. These types of examinations should therefore stay and be strengthened.

The preceding views become increasingly important when the question of the international

equivalence of diplomas/certificates is considered. As more students leave schools and universities to go abroad for undergraduate, graduate, post-doctorate and research studies, where do they stand ? What, for an example is the value in the U.S.A. or Germany of a diploma a·varded in Shanghai, Japan, Nigeria or the Philippines? And, when these graduates return, what will their foreign degrees be worth in their countries? These are important questions that must be answered when countries begin any process of abandoning this system of national accreditation of their schools' diploma.

In spite of the anomalies contained in the system, it appears clearly that the odds are against abolition. The trend today is rather towards a greater emphasis on nationally recognized examinations world-wide. Most educators in the countries already mentioned in this paper appear to view their national examinations as a blessing and not a disease in their educational systems (Atiyeh, 1962; Ahmed, 1985; Akanbi, 1996; Okebukola, 1977). On the other hand, the experience of countries such as Nigeria appears to suggest that we must not rely completely on a national examination system whereby students are taught by one teacher but are evaluated by an entirely different (or external) person. Teachers and local authorities should be given more freehand in the evaluation of

their students - who they know better than anybody!

Conclusion

There are multiple challenges that face national examinations in centralized educational systems: First, ensuring that the national examinations will encourage the best type of teaching; secondly, achieving economy, reliability and objectivity without damaging the organic unity of learning, third, finding the types of questions which would both reflect the stated educational objectives and provoke in teachers, a critical attitude towards their teaching methods. As a result of these challenges, it is suggested that significant efforts in the field of education should be directed along the following lines: exerting pressure for greater co-ordination between examination practices and educational theory, ensuring that the impact of examinations on teaching is wholesome: and, conducting more extensive researches into the improvement of oral and practical examinations. Because most countries operate some type of centralized educational systems, scores in the nationally constructed examinations determine to a great extent, selection for further education. Hence, genuine efforts are needed by all those concerned in these countries to resolve the different issues raised in this paper.

In the peculiar case of Nigeria there is need for a more co-ordinated enforcement of existing laws guiding the conduct of national examination. For instance, Decree 20 of 1984 with respect to examination malpractices needs to be invoked. This decree prescribes series of punishments for those who commit or aid examination malpractices at the national level. Such punishments include 25 years imprisonment and dismissal from job for those found guilty. These are currently not being vigorously implemented. Preventive measures could also be embarked upon to minimize obvious problems attached to the conduct of this national examination i.e. the WASCE. These measures could include the production and popularization of books on skills for effective studying, examination preparatory skills and examination coping strategies. No matter what positions an individual decides to take with respect to this discourse about national examinations, one thing is at least obvious in the prevailing circumstances. This is the fact that, an individual's level of education is generally regarded as decisive factor in employment opportunities and in social mobility.

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JAPANESE MANAGEMENT TECHNIQUES : HIDDEN LESSONS FOR EDUCATIONAL ADMINISTRATORS

B. P. MORDEDZI

ABSTRACT

Japan, a leading industrial country in the world, has adopted management techniques that are quite different from those of other countries in the world. These management practices include secure and lifetime employment for workers, consensus and participatory decision-making, group harmony, and group action. Others are relatively slow evaluation and promotion, more informal controls and less formalised measures, broader and non-specialised career paths, and greater concern for workers. This paper discusses key aspects of Japanese managerial practices. To achieve "productivity through people," educational administrators should adopt plausible aspects of Japanese management techniques in their work settings.

Introduction

Educational administrators face many challenges. The primary source of the challenge is change. The change may be due to the reforms in the system of education. Any change in the system of education will put pressure on educational administrators. It will compel them to reassess their methods and goals as they strive to deal effectively with the competitive educational environment.

Educational administrators are managers of educational institutions. As such, they need good management techniques to carry out their tasks. This will enable them to gain a competitive edge in an increasingly complex educational environment. One important way by which educational administrators can gain competitive advantage is through innovation, How do educational administrators promote such innovation within the educational system? How do they accept their expanded roles and lead others in the quest for excellence? In what ways do they adapt the practices of successful businesses to their situation? Such are the exacting challenges that educational administrators face in the contemporary competitive educational environment. This paper

addresses some of these issues from the viewpoint of Japanese managerial practices.

What is Management ?

Several definitions exist for management (Brech, 1975; Fulmer, 1983; Weihrich & Koontz, 1993). Perhaps, the most succinct definition of management was offered by Holt (1987). Holt defined management as the "art of getting things done through others" (p. 10). In other words, the manager co-ordinates the work of others to achieve goals that might not be achievable by an individual. This paper defines management in a different way. Management is the process of setting goals through the ten management functions by making effective use of human, financial, and material resources in a changing environment. The key elements in this definition include making conscious decisions to set and achieve meaningful goals, working with and through others, and executing the ten management functions. The rest are balancing a effectiveness and efficiency, getting the most out of limited resources, and operating in a changing environment.

The Management Process

Aldrac and Stearns (1987), Barnard (1968), Bartol and Martin (1981), Brech (1975). Durker (1979), Fayol (1949), and Weihrich and Kontz (1993) view the management process as a set of related activities and tasks. These activities and tasks include the following

Planning : choosing the purpose and objectives of the organisation and selecting the means to achieve them.

Decision-making : understanding and analysing problems and developing and choosing among alternative solutions.

Directing (or Commanding) : exercising central authority, giving instructions to subordinates to carry out tasks, guiding and supervising subordinates.

Organising : establishing a framework within which duties are to be performed.

Co-ordinating : making sure that all groups and persons work effectively and economically, in harmony towards the common objectives of the organisation.

Staffing : identifying human resource needs and filling the organisational structure and keeping it filled with competent people.

Communication (or Reporting) : conveying to employees technical knowledge, instructions, rules and information required to get the job done.

Motivation : urging individuals to pursue collective objectives by satisfying needs and meeting expectations with meaningful work and valued rewards.

Leading : acting as inspiring leaders by serving as role models and adapting managerial styles to the demands of the situation.

Controlling (or Budgeting) : setting standards, measuring performance, and correcting undesirable deviations.

Mintzberg (1980) proposed another method of examining the management process by introducing the idea of managerial roles. Mintzberg identified ten managerial roles which were divided into three major groups. These are interpersonal roles, informational roles, and decisional roles. First, among the interpersonal managerial roles, a manager performs a figurehead's role. The manager attends to activities of a ceremonial or legal nature. The manager also performs a leadership role by exercising authority within the organisation. Again, the manager acts as a liaison, co-ordinating various functions and subordinates.

Second, within informational roles, a manager can be a monitor, receiving and collecting data about the organisation. The manager can also be a spokesperson, providing information about the organisation to outsiders. Further, the manager can be a diseminator, providing data within the organisation.

Lastly, in a decision-making managerial role, the manager can be an entrepreneur, exploiting new opportunities and introducing change. The manager can also be a disturbance handler, taking corrective action when the organisation faces unexpected difficulties. Besides, a manager can be a resource allocator, directing organisational effort towards specific activities. Yet still, a manager can be a negotiator, representing the organisation in bargaining and negotiations.

What do educational administrators do? In other words, what are the managerial roles of educational administrators? Educational administrators plan and take decisions. They set educational goals and develop strategies to reach the goals. They take decisions on materials, monetary, and human resources. Again, they plan the programme of learning and teaching, and resolve conflict between the staff, learners, and schools.

Educational administrators also organise. For example, they buy items for the school and allocate limited resources of all types. Also, they organise routine matters and learners' activities and assign tasks to staff

and learners. Besides, they establish an organisational structure and procedures for accomplishing educational goals.

Educational administrators are guides and bosses. They tell subordinates what to do and watch over them to make sure that they do it. Thus, they issue directives or give commands. For instance, they give assignments to staff and learners, explain routines, clarify educational policies, and initiate action on educational issues

Another managerial role of educational administrators is co-ordination. Educational administrators get things done through others. They delegate duties to staff and learners and co-ordinate effectively how staff and learners carry out their delegated duties. Also, they co-ordinate the use of funds, facilities, and equipment possessed by the school. They also establish contacts with outsiders.

Motivation and leading are central to the work of educational administrators. Educational administrators encourage harmony needed to assure effective performance and attainment of the goals of the school. Also, they entertain officials from the Ministry of Education, Ghana Education Service, and other agencies. Again, they oversee official school functions and other public events. Finally, they influence other staffs who share in the education of the learners

Educational administrators define the personnel requirements for each job. Thus, they perform staffing duties. They recruit, select, train, and develop teachers and office workers. Again, they admit learners. Furthermore, they place teachers, office workers, and learners where they will be most effective. They also compensate staff.

Communication (or reporting) is an important element in the work of educational administrators. Educational administrators receive information about the operations of the school. Also, they provide feedback on the performance of the school. Again, they pass information about the school to stakeholders such as parents and officials from the Ministry of Education, Ghana Education Service, and West African Examinations Council. Finally, they transmit information to staff and learners about educational matters.

Educational administrators must conduct checks to see that work goes on according to plan.

Controlling (or budgeting) is therefore a key managerial role of educational administrators. The administrators establish clear performance standards for staff and learners and monitor their performance compared with standards. Also, they measure results against objectives and plans. Finally, they control indiscipline in the schools and offices.

What is Japanese Management?

Japanese management refers to those managerial practices that have helped Japanese companies to excel in the world market. Japanese management is based on Theory Z (Ouchi, 1981). The key features of Japanese management are :

1. Lifetime employment for permanent workers;

2. Promotion of workers from, within the organisation;

3. Mandatory retirement of permanent workers at age 55;

4. Employment of many temporary workers, mostly women

5. High degree of mutual trust and loyalty between management and employees;

6. Non-specialised career paths with long job rotation as a central feature of career development;

7. Collective decision-making;

8. Long-term performance appraisal, usually ten years after initial employment.

9. Encouragement of collective responsibility for the success of the organisation, and cooperative effort rather than individual achievement;

10. Support for industrial life by a highly competitive educational environment;

11. Financing of large firms by major banks and supported by a host of satellite firms. (Cole, 1990)

Japanese Management in Practice

Theory Z combines human relations ideas and scientific management techniques. This has provided distinctive characteristics for Japanese businesses within the management process. These characteristics are summarised as follows:

• *Planning and Decision-Making* : The Japanese have long-term orientation in planning. Emphasis is on decentralised and collective decision-making with consensus. Also, many people are involved in decision-making but top management has the final authority for making decisions. Because many people take part in decision-making, the process is usually slow but implementation is fast. Critical decisions flow from top to bottom while non-critical decisions flow from the lower-level to top management. Finally,

in decision-making, there is a great deal of collaboration between the decision-makers and a recognition of mutual dependence.

- *Organising*: Japanese businesses place emphasis on collective responsibility and accountability through conciliatory communication. Also emphasis is placed on informal organisational structure and democratic relationships based on trust rather-than formal authority. There are common organisational structure and philosophy with emphasis on unit and harmony within the organisation. Finally, Japanese companies encourage competitive spirit towards other organisations.

- *Directing and Co-ordinating*: Japanese chief executives avoid face-to-face confrontation with their employees in order to maintain harmony. Co-operation in Japanese companies is facilitated by common values and team spirit. As a result, the managers place themselves in the place of the employees to get the work done. Also, workers and managers subordinate their self-interests to group and organisational interests.

- *Staffing*: Japanese companies hire their workers out of school and the workers hardly change

employers. In Japan, less emphasis is placed on specialisation but more emphasis is on flexibility and job rotation. This leads to broader career paths for workers since they are exposed to many work situations. Japanese companies also make heavy investment in the training and development of their employees. Again, there is slow and systematic advancement through the ranks. Loyal and harmonious behaviour, merit, seniority, and educational background are considered when the opportunity arises for promotion. While part-time employees are usually dismissed during periods of economic slowdown, permanent workers are guaranteed life-time employment. Instead of being laid off, permanent employees are transferred to other units that need additional help.

- *Motivation and Leading* : Companies in Japan show great concern for their employees. They provide them with housing, day care services, medical care, counselling, insurance, and subsidised loans among others. The managers act as social facilitators and group members. They create an environment of esprit de corp by associating themselves with workers both within and outside the work

environment. Japanese companies also give group rewards.

- *Communication* : Patterns of communication in Japanese businesses follow those of the decision-making. Thus, the flow of critical communication is top-down and bottom-up while non-critical communication is often bottom-up Also Japanese managers place emphasis on face-to-face contact rather then memos. This promotes cordial relations between employers and employees and enables them to reconcile differences of opinion.

- *Controlling* : Control in Japan means placing emphasis on quality control and process control methods, not numbers. The control focuses on group performance. Peers at the shop-floor are allowed to measure individual performance rather than setting it against pre-determined standards. Also extensive use is made of quality circles by allowing employees to participate in decision-making and quality control. Members of the quality circles identify and solve problems unique to their work settings.

Implications for Educational Administration

Educational institutions are like living organisms. They have the power to adapt to changes in the educational environment. Educational administrators who are unable to adapt cannot withstand the fierce competition in the next century. Japanese management techniques therefore offer several lessons to educational administrators in the management of educational institutions. Some of these lessons include:

* Making large investments in staff and guaranteeing the security of staff through good and bad times.

* Providing opportunities for staff to get a variety of skills through varied non- s p e c i a l i s e d experiences such as job rotation between the classroom and office administration.

* Tying promotions to skills, contributions to the growth of the school or educational office, and the number of years spent on the job while providing opportunities for advancement for young employees.

* Supplementing objective analysis of facts by personal judgement and feelings about what is right or wrong, appropriate or inappropriate.

* Using consensus to reach decisions and to accomplish smooth implementation of decisions.

* Encouraging group action in the discharge of duties but fixing ultimate responsibility for decisions with relevant individuals.

* Paying careful attention to employees' well-being from the time of recruitment to the time of retirement.

* Establishing cordial boss-subordinate relationships that encourage a degree of affinity for 'freedom and effective collaboration.

Conclusion

Areas of differences exist when Japanese and non-Japanese managerial practices are compared. These differences are due to differences in culture. Japanese people are traditionally group-oriented, hard-working, and committed to their organisation. They seldom change employers. They are also homogeneous in terms of race and religion. In contrast, non-Japanese people, particularly those who share many cultural aspects of Americans and Europeans are highly mobile, achievement-oriented, and innovative. Adopting managerial practices based on Japanese principles may contrast with non-Japanese culture. However, educational administrators with non-Japanese

orientation can take advantage of themost important aspects of Japanese management. These aspects centre on consensus decision-making, organisational communications, harmonious role expectations for managers, quality circles, and a high level of worker participation. These means that educational administrators must "think quality, be competitive and treasure their employees' (Hasegawa, 1986: 156). They should therefore become strategic thinkers and planners that have a vision of what their schools and offices are and what they could be in an ideal world. Indeed, Japanese management practices must jolt educational administrators into action. These practices must guide the administrators in crafting strategies in terms of how to manage educational institutions, how to lead, how to use resources and how to design, deliver, and manage educational programmes and courses.

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PLANNNG PRIMARY EDUCATION TO AMELIORATE THE WRENCHING EFFECTS OF ADJUSTMENT

J. B. Babalola and A. L Sikwibele

ABSTRACT

Structural Adjustment Programme has negative effects on participation in primary schooling, funding of education and quality of primary education in developing countries.

Owing to the declining proportions of government budget to education, the growing number of children to educate and the rigidity of the institutional framework for planning, there has been serious gaps between vision and action in the provision of education. Highlights of the suggested policy framework for improving the planning of primary education to ameliorate the effects of SAP in Nigeria include : expansion of access to schooling, improving equity in the provision of education, enhancing quality and learning achievements, improving teachers' performance, increasing funds and resources and managing them for optimum utilization. Practical activities for carrying out the policies are suggested.

Introduction

Structural Adjustment Programme (SAP), as described by the World Bank (1988 : 1), has a "wrenching" effect on the public expenditure on education, the purchasing power of the institutions of learning and their staff, and on access, equity and quality indicators in education at the first level in Nigeria ((Babalola, Lungwangwa and Adeyinka, 1997 : 12). Losers from SAP in Nigeria include teachers and other staff whose salaries have been eaten up by inflation; poor children who could not afford the high private costs of education, namely school leavers who could neither continue their education nor get employment as a result of narrowing labour market situations; access victims who could not participate in secondary school education owing to supply problems; and school libraries which owing to foreign exchange and devaluation problems could not source quality materials. The above describes the type of learning environment in which Nigerian pupils " learn" under SAP.

Yet, primary schools in Nigeria are expected to produce a literate and numerate population to lay the ground work for further education (Babalola, 1996 : 139). The question is: considering the declining public expenditure on education during adjustment in Nigeria, has primary

nation. The drop in gross enrolment ratio became significant since the inception of SAP in 1983 when Nigeria signed a credit agreement with the IBRD for a loan of US $250 million to import fertilizer (World Bank, 1995, Annex-Table 1:276).

Between 1983 and 1987, the ratio

Table 1 :
Primary Education Under SAP in Nigeria

	Gross Enrolment Ratio		Pupil per school	Pupil-teacher ratio
	Both Sexes	Female		
1975	53	45	291	35
1980	97	84	377	37
1981	98	84	381	37
1982	97	84	387	38
1983	92	81	376	40
1984	—	—	—	—
1985	82	73	375	44
1986	—	—	—	—
1987	68	59	333	43
1988	72	62	364	42
1989	70	63	384	45
1990	72	63	389	41

Source :
Culled from : UNESCO Staistical Year Books (1988, 1991, 1992 and 1995)

edcation been able to meet its objectives? As far as the gross enrolment ratio or both sexes is concerned, since 1975, Nigeria has increasingly failed to provide all school-age children with the opportunity to attain necessary skills that would enable them to contribute effectively to development of the

dropped by about 20% (Table 1). The implication of this trend on access to primary education is obvious.

Table 1 reveals a significant downward trend in female participation in primary education in Nigeria following SAP in 1983. The Female gross

enrolment which was 81% in 1983 dropped to 63% in 1990. The implication of low participation of girls in primary education cannot be over-emphasised. The ability of Nigeria to appropriate the socio-economic advantages of education will be depressed as more girl-children are being excluded from taking part in primary education (Babalola, 1996 : 140).

With repsect to the number of pupils per school, the school size jumped from 291 in 1975 to 377 in 1980. From 1983, there was almost a constant trend in school size. However, the class size was reduced from 376 in 1983 to 333 in 1987. From 1987 upwards, Nigeria experienced the second episode of increasing school congestion as the school size increased from 333 in 1987 to 389 in 1990. The effect of school congestion on the quality of instruction is obvious.

Another indicator of quality of instruction is the pupil teacher ratio. In Nigeria, 40 pupil per teacher has been considered the critical ratio for effective learning. Table I shows that, constrained by money during adjustment, Nigeria was making a desperate effort to manage its resources including teachers. Hence, Nigeria upgraded the number of pupils handled by each teacher from 40 in 1983 to 45 in 1989.

As far as completion rate is concerned public primary schools in Nigeria were faced with the problem of low completion rate following SAP. Out of the 2.762 million 1986 primary school chort, five percent did not complete primary four by 1989; 56% of this number were girls (Babalola, Lungwangwa and Adeyinka, 1997 : 7). Since successful completion of primary four class level is considered as threshold for attaining permanent literacy and stimulating socio-economic growth, the low completion rates following SAP compromise the system for human capital development in the future (Babalola, 1996 : 141).

Having diagnosed the trends in primary education development between 1975 and 1990, it is meet to highlight what should be done to ameliorate the wrenching efects of SAP in Nigeria in terms of proposed plan objectives for the twenty first century.

Planning the Educational Objectives

From the above discussions, we notice that the following gaps in primary education development have been created by the implementation of SAP in Nigeria:

(a) rather than move towards primary education for all, Nigeria was moving far away from that goal;

(b) instead of experiencing more female participation in primary education, the country was grappling with a decreasing level of girl participation;

(c) a significant proportion of those who started primary school dropped out before reaching the fourth grade which is considered to be the threshold of literacy and numeracy;

(d) the learning environment was gradually becoming unconducive as SAP bit harder on the provision and maintenance of learning resources; and

(e) the quality of priamry education provided was increasingly being eroded by various cost reduction measures necessitated by SAP.

One important planning question is "what are we going to do to bridge these gaps?"

It is suggested that Nigeria as a nation should make deliberate efforts to salvage public primary education in the country. As the twenty first century dawns, the planning efforts should be directed at achieving the following sectoral objectives at all levels of primary education administration in Nigeria:

1.   The dominant goals of all primaty schools should be excellence, and quality. These should become the national, state, local community, parental, school and learner's slogan;

2. In quest of excellence and quality in the provision of primary education, there is virtually no limit to the amount of money an institution could spend. Every institution associated with primary schooling should aim at optimal utilization of educational resources. Consequently, another important objective for the first planning period in the next century should be to make the best use of the available resources at the school, district, state and national levels;

3. Efficiency in primary education delivery should be emphasised in the next century through an encouragement of framework and initiatives which will bring about efficient distribution of responsibilities among pupils, parents, parent-teacher associations, religious organizations and public authorities;

Equity in provision of primary education should be a priority in the next millenium. Education policies, programmes, projects and budgets should contribute to ensuring that every child in Nigeria is able to benefit from educational opportunities designed to meet

their basic learning needs through a compensatory provision of education for those who are most at risk - the poor, girls, the disabled, rural children, and those affected by HIV/AIDS.

5. Relevance of primary education to socio-economic development should be emphasized in Nigeria through reforms which will make parents feel like sending children to schools even if it means paying heavily for the education provided;

6. Parnership and collaboration in the provision of primary education should be two major principles which must guide educational policies, reforms, programmes and projects in the year to come; and

7. Accountability in the use of education resources should be an imporant planning objective at all levels of primary education management in the next millenium. Support should therefore be given to initiatives which make users pay for educational services they enjoyed which will make workers justify the salaries they are paid, and make providers more responsive to the needs of parents and pupils.

The foregoing has been a discussion of the main planning objectives which, it is suggested, Nigeria should aim at achieving in the future. The section that follows deals with some of the main constraints which may hinder the achievements of the highlighted objectives.

Constraints to be considered

Nigeria is good at visioning but owing to the following real life constraints, there have always been serious gaps among visions, mission and action in the provision of primary education. Constraints such as political instability as it affects continuity in government's visions and actions will be avoided so as to make our discussions as practicable as possible. However, this aspect will be discussed by the following levels of decision-making in primary education to associate each constraint with the corresponding locus of action.

At the National and State Levels

Financial constraints seem to be at the centre of discussions in the present day Nigeria. The Federal Government, in response to the conditionalities of SAP, has continuously made efforts to reduce public expenditure on educaton. For instance, per capita education spending dropped from US $ 5.6 in

1981 through US $ 3.9 in 1983 to US $ 1.1 in 1988. (Babalola, Lungwangwa and Adeyinka, 1997). As far as the share of education in the national budget is concerned, Nigeria experienced downward trends from 1984 when education share was 8.0% per cent. By 1986, Nigeria exprienced about three per cent drop in education share and by 1988, the country experienced about six per-cent drop in education share when compared with the 1984 level.

Consequently, the education expenditure per child which was US $ 82.92 at the inception of SAP in 1983 DROPPED TO US $ 55.59 in 1985. As rightly observed by Adeyinka (1993:9),

> The financing of Nigeria's education system has reached a crisis point. Government does not seem to be able to make adequate provisions for capital development in the various educational institutions. Classroom accommodation ... does not seem to be adequate ...

Second, the governments are constrained by the ever increasing size of the public primary education sub-sector in the face of dwindling economic strength. Before Nigeria's independence, the colonial government directly and effectively managed the few public primary

schools under her control and did not neglect the ones owned by the missions and the native authorities. Following independence, however, the introduction of the Universal Free Primary Education (UPE) policy led to an unexpected increase in the number of primary schools owned, financed and managed by the government. The consequence of the over centralization of ownership and funding of primary schools in Nigeria is the government's failure to provide primary education in the right quantity and quality.

Third, comprehensive planning of primary education development is constrained by the institutional setting of educational planning and administration in Nigeria. There is no "clear" framework within which educational planning and administration are to be carried out. The tendency to strike a balance between centralization and decentralization of primary education has made it difficult to predict the line of action of government concerning management of primary education. As a result, there are complaints of inconsistent policies concerning primary education in particular. Often, there are contradictions, confusions and conflicts among major stake holders in primary education. Moreover, the institutional framework for planning gives room for neither flexibility nor discretionary decisions and actions.

For instance, review of education policies and laws are seldom made, and when reviews are made, they come at a time when events must have overtaken such reviews. In fact, little attempts are usually made to initiate primary education reforms in response to the complaints, criticisms and demands of the local poeple and international communities. As an illustration, private primary schools in Nigeria are always aware that parents are largely interested in getting their children admitted into secondary schools of pupil's choice. They further encourage speaking of the English language among their pupils. On the other hand, public primary schools seem not to be responsive to the immediate needs of parents and pupils owing to the rigid framework within which things are done in the public schools.

At the Local Level

One serious constraint at the local level is the low revenue generating capacity of many local government councils in Nigeria. Most of the local government councils heavily depend upon their meagre allocation from the Federation Account to finance both capital and recurrent expenditures on education, health, roads and so on. Unfortunately, corruption or lack of transparency which is widespread in Nigeria has made Federal Government to be reluctant

to provide more resources for the local authorities. The most frequent types of corruption encountered at the local government level include bribes to have compromising documents removed from files, fraudulent use of official stationery, diversion of public funds, presentation of false bills and frauds by revenue collectors.

While local governments cannot be singled out in matters relating to corruption in Nigeria, there are certain things which make them more vulnerable to lack of transparency. First, poverty is more pronounced at the local level than at the central level. Povery is capable of generating systems of patronage and dependence which can force poor people to tolerate, initiate or take advantage of corruption in official circles (Gould and Amaro-Reyes, 1983, in Babalola 1993 : 160). Second, corruption can be encouraged by the community spirit and cohesion at the local level. There are fewer corruption watchdogs in the rural sector than in the urban sector of the Nigerian economy. Third, there is shortage of qualified personnel such as accountants, auditors and planners who are expected to plan and enforce financial accountability. The lack of accountants and auditors to ensure proper authorization of funds and enforce rules and regulations

concerning the use of resources does not only encourage corruption at the local level, it also hinders devolution of financial power to the local level in education. Similarly, the lack of educational planners make devolution of planning and decision making power difficult.

At the School Level

Poor supervision and control to ensure quality of education at the primary school level is a serious problem in Nigeria. In fact, the poor control system coupled with a lack of performance-based incentive system has made teachers in public schools to become less committed than their counterparts in the private schools inspite of the fact that those in the private sector are less paid.

Community insensitivity to schooling problems has also constituted a serious bottleneck. This is owing to the fact that parents who have their children in public schools are mostly poor and uneducated. It is therefore almost impossibble to moblize sufficient community resources into the public primary school systems.

Public primary schools are generally faced with low capacity to take important decisions and initiate necessary actions. Unfortunately, the private schools which are quite good at quick decision and prompt actions are restricted to the urban centres. Unlike the private schools, public schools are not given the legislative freedom to select desired inputs, charge fees, and control process and output. In fact the tradition of free education is a serious bottleneck to any financing reform aimed at cost sharing at the primary level in Nigeria. Having identified some of the constraints to school effectiveness in Nigeria, we now turn to the next section which attempts to suggest possible solutions.

Strategies to Ameliorate
SAP Effects

As the 20th century movrs to a close most institutions talk of strategic planning containing a set of actions aimed at enhancing the organization's ability to achieve its goal. Once the National Policy on Education has determined the long-term objectives of all institutions connected with the provision of instructional services, it becomes the task of the educational managers within each institution (Ministry of Education at federal and state levels; National and State Primary Education Boards; Local Government Primary School Boards; and Schools) to decide the best way in which to achieve the broad objectives over the years that follow.

School Effectiveness Strategies

Given that the main purpose of any primary school is to privde literacy and numeracy skills to children between ages 6 years and 12 years, and help them to gain admission into secondary school of their choice, the following strategies may be adopted (World Bank 1995):

(a) *Setting Stanndard for Quality Assurance*

It is the duty of the government and its agents to help improve academic achievement at the primary level by setting clear and high performance standards in every subject.

(b) *Supporting the following five main educational inputs*

(i) *Students' capacity and motivation to learn* can be increased by encouraging high-quality pre-school educational programmes; providing child nutrition programmes, school-health programmes, and learning environment improvement programmes.

(ii) the subject to be learnt (curriculum) can be improved by linking the subject to be taught to performance standards and measures of outcome. Will this subject lead to acquisition of the needed skills, help the pupils in gaining admission and enhance the reputation and attractiveness of the school? The government should furnish general guidance on the frequency and duration of instruction. At present, every subject at the primary school lasts for equal number of minutes. Teachers in public schools, in practice, teach only about one-quarter of the expected number of subjects. The language of instruction is not strictly specified. While English language is highly encouraged in the private schools the vernacular is commonly used in the public ones. There is the need for a national policy (guideline) on the more effective language of instruction (English or Mother tongue). The content of what is learnt is also important with respect to the creation of a girl-friendly primary school. There is the need for government to have a clear guideline on making the curriculum gender-senstive, and gender neutral.

(iii) the teacher who knows the subject and how to teach it can be developed through human resourse development approaches such as headteacher organised in-service training to

improve teachers' subject knowledge and related pedagogical practices.

(iv)   the time for learning can be extended and improved by extending the official school year, reducing unscheduled school closing, teacher and student absence, and miscellaneous disruptions; permitting flexible time-tables to accommodate seasonal variations, holidays and children's domestic chores; and by assigning homework.

(v)   the tools for teaching and learning can be improved by supporting any initiative aimed at improving instructional materials such as blackboards, chalk and textbooks. Reading skills require acquisition of supplementary reading material.

c.   *Increasing flexibility at the local and schools levels*

School governing boards, head-teachers and teachers are best able to select the most appropriate school inputs, such as texbooks and teaching methodology, owing to their intimate knowledge of the local conditions. Government needs to come out with clear guidlines on devolution of power which will make primary schools become clearly accountable to parents, communities and pupils; encourage shared goals regarding the learning objectives of the school; encourage flexibility in allocating instructional resources; and encourage school - based leadership. The last section of this paper highlights what we consider as possible sets of actions which can be taken to improve the primary school system in Nigeria.

Suggested Policy Framework for Ameliorating the Negative Effects of SAP

Table 2 contains possible means by which the Nigerian government can address the weak areas in the provision of primary education in the country. The suggestions tabulated are based on literature on the issues raised. The table is self-explanatory: it focuses on how to expand access to primary education and improve equity in its provision, enhance quality and learning achievement, improve teachers' performance, improve textbook production, improve the efficiency in the utilization of education resources, strengthen management capacity and increase funds at the primary school level.

Table 2 :

Sugggested Policy Framework for Improving Primary Education.

What to do	How to do it (Strategy)
Expand access to primary education	(a) *Supply-side interventions* • build more schools and class rooms • hire more teachers • maintain exisiting infrastructure (b) *Demand-side interventiosn* • legislate and enforce compulsory attendance • implement automatic promotion more effectively • reduce direct and indirect costs of primary education
Improve equity in the provision of primary education	(a) *poverty -gap interventions* • provide scholarships, free textbooks,mid-day meals and transport to the weak households. (b) *rural/urban-gap interventions* • provide incentives for rural teachers • institute a rural supervisory system (c) *gender-gap interventions* (i) *supply-side* • increase the number of girl schools • open informal education centres • establish flexible school schedules

(Table 2 Cont'd)

	• provide private toilets for girls • provide transport for girls • appoint more female teachers (especially in rural areas) • give gender-sensitive training (particularly to female teachers) • revise textbooks to eliminate gender bias • subsidize girls' education
Enhance quality and learning achievement	ii. *demand-side interventions* • institute awareness campaigns • provide creches to release girl children from sibling care • provide free tuition, books, food, uniforms and transprot • delegate authority for improvement to the lower levels • institute performance standards at all levels • establish and monitor professional codes of conduct • encourage and coordinate production of instructional materials • give training on learner-centred methodologies • increase number of hours/days of instruction • provide home counselling services • establish norms to enhance school-community relationship • train headteachers on quality control and skills • Encourage establishment and sourcing of school libraries
Improve teacher performance	• Implement teacher qualification standard that makes the NCE the minimum qualification

(Table 2 cont'd)

	• emphasize building of teaching skills in all teacher training institutions /colleges • encourage local level provision of school based in-service training. • improve the conditions of teaching • make promotion contingent on performance - however, develop the criteria for measuring good performance • encourage the use of mother tongue at lower grades
Improve texbook production	• set standards for vocabulary and sentence complexity and length • conduct sample trials of readability and comprehension with students and teachers • invest more on research, writing and book design
Improve efficiency in the utilization of resources	• establish necessary coordinating structures • develop guidelines for cost-sharing among beneficiaries • initiate and implement activities aimed at encouraging private and voluntary sector involvement in primary education.
Strengthen the management and institutional capacity	• train local-level educational planners, village education committee members and headteachers on education management. • strengthen the state primary education boards to provide support at the village and school levels.

(Table 2 cont'd)

	• estabish a management information system to provide more accurate and timely education data for use at all levels.
Increase funds at the primary school level	• develop a wider revenue base to improve resource mobilization • increase shares of expenditure to primary education • develop financial incentives to stop diversion of funds • enable the local governments to raise additional revenues from taxes that may not be available to the state governments • reduce repetition and dropout rates to reduce cost per graduate

Summary

This paper has made the attempt to diagnose the primary education system under the Structural Adjustment Programme in Nigeria It has identified areas where there is need for deliberate intervention as the twenty first century dawns, and based on literature, it has highlighted various initiatives which can be used to ameliorate the negative effects of SAP. It is the belief that details concerning who to do what, when, what should be done and with what resources, will be developed at all levels of primary education management in the country. Readers may find this paper useful as a guide in understanding the technique of planning in the education sector. It is therefore important to follow the process, starting from the diagnosis of the education system, through the formulation of major educational policies (guidelines). The paper has drawn a proposal policy framework but has been unable to prepare the detailed work plan. This gap can be filled by any interested reader and researcher.

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APPLICATION OF MANAGEMENT PRINCIPLES IN UNIVERSITY ADMINISTRATION: A CASE STUDY OF UNIVERSITY OF CAPE COAST

*(Paper Presented at a Workshop on Induction
Programme for Newly Appointed Deans, Heads of Departments/Sections/
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J. S. K. Owusu

ABSTRAT

The paper discusses certain principles of management which, it is hoped, will guide newly-appointed personnel in management positions in carrying out their duties as leaders.

The functions involved in management including planning, organizing, supervising, directing, controlling, coordinating and budgeting are briefly discussed. Other important aspects which should receive the attention of deans and heads of departments, sections and units are discussed in rather detail. Such aspects include human and public relations, delegation of authority, communication, leadership styles and management of change.

Important aspects of human and public relations such as the need for the head to establish cordial relationships with people within and outside the organization are raised in the paper. The importance of delegation of authority, barriers to effective delegation, and other aspects of delegation are discussed. Issues raised on leadership styles point to the need to regard each style as a sound approach to

management and that the choice of style depends on the situation or problem at hand.

The need to plan for change in view of the technological development of the modern world receives attention.

Introduction

Management is a key aspect in any organization. The success or failure of any organization depends, to a large extent, on the degree of effectiveness of its management. Management takes place in three major spheres, namely, in business organizational setting, in political or semi-political situations and in institutional/educational setting. The title of this paper should have been Principles of Management since many of the principles are touched upon, but I prefer maintaining the topic as it is since the paper raises a lot of issues which are related to the

practical functioning of Deans, Heads of Department, Sections and Units at the University of Cape Coast

Some specially selected aspects of Principles of Management which directly relate to the work of the basic clientele of this paper are treated.

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In the paper, the word "head" has been used in a very generic sense in many cases to refer to the Dean, Head of a Department or Head of a Section or Unit.

Definitions of Management and Principles

The term management has been defined in diverse ways. Everard and Morris (1990) consider the term, in its broadest sense, as

- setting direction, objectives, aims, goals;

- planning how to make progress towards achievement of a goal;

- organizing available resources - men, money, materials and time - so that the achievement of a planned goal can be approached economically;

- controlling the process towards achievement of a planned goal;

- setting organizational standards and making efforts to improve upon them.

They state also that a manager is one who directs the work of others.

In a similar vein Barnard (1938) regards management as the "arts to accomplish concrete ends, effect results, produce situations, that would not come about without the deliberate efforts to secure them" (pp. 290-291). Follett, in Stoner (1978), defines the term in a simple way. She says management is "the art of getting things done through people" (p.7). This tells it all.

We may find it expedient to have a look at the meaning of principles. Commonwealth Secretariat (1993) states that "a principle is a generally accepted truth which is based on experience and the available information" (p.8).

Functions of Management

Management is carried out by managers who are heads or leaders in a broad sense. Heads of Departments and Deans of Faculties therefore carry out their functions in the same or at least similar way as managers of

public and private businesses and corporations do. They could therefore be referred to as managers. In performing their management role, managers carry out a number of functions which we need, at this juncture, to analyse in order to be abreast with some of the functions which Deans and Heads have to carry out. These functions include planning, organising, supervising, directing, controlling, co-ordinating and budgeting.

Planning. It is necessary for Deans and Heads, as managers, to plan for the development of their faculties and depaetments and to achieve efficiency. Planning, in this sense, involves setting goals or objectives for future development, prioritising these goals since they may be many and cannot all be achieved, mobilizing and allocating resources that will work towards achievement of the goals or objectives. They then have to identify strategies to be adopted to achieve the goals or objectives. The goal is to be achieved within a specified time-frame. Planning enhances achievement of efficiency and effectiveness. Efficiency, in our sense, refers to using a given input to achieve maximum output within time. Akangbou(1987) defines educational efficiency as "the relationship between the outputs of the education system and the inputs used in producing such outputs" (p.90). In

the words of Owolabi (1998),"efficiency is the optimal relation between inputs and outputs. An activity is being performed efficiently if a given quantity of outputs is obtained with minimum inputs or if a given quantity of inputs is able to yield maximum outputs" (p.40). Effectiveness refers to achieving the required standard in performance. It is oriented to achievement of quality and sound objectives, that is, objectives desired to be achieved. Heads of educational institutions generally or heads of departments, as managers, should consider planning a serious function for the development of their institutions or a segment of an institution.

Organising. To organise has as its root the word **organ** which is a part of a system. It is the combined functioning of the various organs of the system that makes the system work effectively. To organise is to put together the various organs or parts, that is, resources to enable the system function. O'donnell and Weihrich (1980) observe that "the term implies a formalized intentional structure of roles or positions" (p.330). The Head of a Department or the Dean of a Faculty is said to organise his department or faculty effectively when he mobilizes and puts together the resources - lecturers, the non-teaching staff, students, funds and materials - at his disposal and

makes sure they are utilized to their full potential within a specified time-frame.

Supervising. Effective supervision is a key factor in goal achievement. To supervise is to rigorously find out that parts of a system are working according to plan. It is to ensure that every resource - man, money, material and time - is utilized to the benefit of the department. The head has to take note of and instil into his staff, the efficient use of money, materials and time. Funds must be utilized to achieve the highest possible returns. Staff time, particularly the time of the junior staff, must be monitored and effectively used. To ensure a more effective supervision, the **span of control,** that is, the optimum number of subordinates who have to respond to one superordinate, should be within a reasonable range. Some writers suggest the optimum number to be between five and eight. In academia, the span could be, in some cases, a little higher than eight without jeopardising effective supervision. This is because very close supervision of academic staff members is not always necessary. In a university setting where every lecturer is a specialist and the academic staff members are so disciplined that they are expected to work effectively at their own rate, it is hardly necessary for the head to strictly monitor the use of time and assiduous performance of such staff members. However,

occasional checking of how each lecturer is performing is expected of a serious head.

Directing. The head, as manager, has to direct the affairs of his organization. He has to initiate action and show the way activities should be carried out. The directing or controlling process, Stoner (1978) points out, "involves three elements: establishing standards of performance, measuring current performance and comparing it against the established standards, and taking action to correct any performance that does not meet those standards" (p.19). The head's directing activities are greatly brought to bear on his staff mostly at meetings. During a meeting, the head outlines or directs how he wants activities to be carried out. At other times, instead of calling meetings he may send out memos or other forms of information around staff members, directing, that is, indicating how he expects certain functions to be carried out.

Co-ordinating. The head has to co-ordinate the activities of his unit/ section/department. That is, he has to see to the working togetherness of all the parts of the system. People have to carry out their functions when they are expected to do so. For instance, when a lecturer has to start a lecture at 7.30 a.m. and the officer who has to open the door has not done so, some function of the department

cannot proceed as planned. The lecture, in this sense, could be unduly delayed. The problem with co-ordination of activities in the university setting is that sometimes the human capital component of resources may be available but the required physical resources - particularly students' textbooks and some required equipment - may be found wanting. Given adequate resources Heads and Deans should endeavour to steer affairs towards effective functioning of their departments and faculties.

Monitoring and evaluation. These are closely linked terms of which heads should never lose sight. The head has to constantly monitor and evaluate the activities of his department. Monitoring involves following the functioning of the system so as to determine whether there are no deviations; to find out whether parts of the system are working as planned, that is, whether the achievement of departmental goal is on course and not a departure from what is expected. Evaluation involves examination of results likely to be achieved if the programme of activities of the department is followed as planned. In other words, if the programme is found as being followed but evaluation reveals that expected results are not likely to be achieved, it becomes necessary for the head to make adjustments in the planned programme towards achieving the required results. Both

monitoring and evaluation ensure successful achievement of the goals the department pursues. Monitoring reinforces effective supervision of the activities of the department.

Budgeting. The Head of Department has to prepare and submit annually to his Dean budget estimates covering the activities of the department. Budgeting entails identifying the work programme of the department for the ensuing year, setting out priorities, summarising the priorities and converting these activities, where applicable, into monetary terms. Budgeting covers the **personal emoluments** of the personnel of the department, including the salaries and allowances of the staff - both senior and junior - and costs in connection with the travelling programme of the members. It covers, in addition, the **administrative activities** of the department, such as costs of utilities, postal charges, office cleaning, office consumables, printing and publication and maintenance. These are activities requied to equip, maintain and run the department to enable it perform its services. Thirdly budgeting covers such **service activities** as teaching, training and conferences costs, consultancies, materials and consumables, stationery, refreshments and entailments, and travelling and transport costs in respect of these service activities. Fourthly, budgeting covers **investment activities**, such as costs to be incurred in connection

with purchase of vehicles, library books, equipment, furniture and such other items that the department may require for its effective operation.

The budget estimates from the different academic departments have to be submitted to the Dean who collates and summarises these estimates for their onward submission to the Finance Officer of the University. The submission of budget estimates from the other units/sections follows a similar pattern. It would be really helpful if Heads of Departments/Units/Sections could prepare and submit their annual budget estimates to the University's Finance Officer, through their appropriate Heads/Deans to enable the University determine, fairly closely, its total annual financial requirements and submit same for funding. A lot of departmental demands for supplies, equipment, etc. which are often not met may be due, in part, to our inability to prepare annual budget estimates for those items.

Other important aspects that should receive the head's attention include the following:

Human and public relation.

Heads of departments cannot single-handedly work to achieve the goals of their departments. The well known adage states "one tree cannot be a forest." Heads need the co-operative efforts of the other members of the departments, both senior and junior . Efforts should be made to obtain the fullest potential of all staff members. They should be given the necessary motivation by the head. To achieve this, it is urgently important to know the behaviour, including the likes and dislikes, of each member of staff so as to enable the head to satisfy, as much as possible, the needs of his staff members. This aspect is important because the human factor could cause problems and failures to the department but it could also result in achievement of success in the department, depending on how carefully the head handles the people with whom he works.

The achievement of the goals of the department depends not only on the availability of financial and physical resources in the department but, perhaps more importantly, on the extent to which sound interpersonal relationships are firmly established in the department. These relationships include:

- the relations between the head and the senior members, senior staff and the junior staff of the department;

- the relations between the head and his dean;

- the relations established among the staff members through the initiative, motivating and persuasive direction of the head;

- the relations between the head and other heads and deans of the university;

- the relations between the head and the students of the department and

- the relations between the head and people outside the university employ who, in one way or another, may have some interactions with the head.

The head has to realize that what he does undoubtedly affects positively, or negatively, the behaviour and performance of those with whom he is working. In like manner, what others do could affect the head's performance. He therefore has to adopt strategies that will help motivate the people he works with so as to enable the department achieve success. He also has to behave in acceptable manners to people outside the university to bring good name to the department and the university at large.

The Commonwealth Secretariat (1993) suggests three stages through which sound interpersonal relationships could be established. The head of department could adopt this procedure to help him establish sound interpersonal relations between him and others. These stages include:

The exploratory phase. This is the stage which involves the head's effort to find out clues and information which will help him to form opinions and impressions about the people with whom he works. This will help him to determine the likes and dislikes of his staff members

The consolidation phase. This phase states that the head should not have to depend on one or two impressions about people and draw conclusions on their behaviour. He will rather have to make observations of repeated behaviour patterns of people to enable him come to know them well and be able to determine "levels of frankness, openness, truthfulness, reliability, credibility and integrity of a person" (p.33).

The preservation phase. This is "the stage of mutural understanding based on trust and acceptance of each other's good and bad points, weaknesses and strengths" (p.33). At this stage the head has sufficiently studied the behaviour of his staff members, has known what they like and dislike, and so tries to do what will motivate them to contribute their maximum output to the growth and development of the department. in

this manner, it is not only the head who will be nice to his staff members, but they, in turn, will also be nice to him, the end result of which is establishment of sound inter-personal relationships which gives a good tone to the department.

Being nice to others does not mean the head should be loose and allow people to do whatever they like, be it detrimental or not to the department. The head does not only have to be fair but also firm in directing activities towards the achievement of departmental goals.

One would agree with Drucker (1970) when he states :

> Warm feelings and pleasant words are meaningless, are indeed a false front for wretched attitudes if there is no achievement in what is, after all, a work-focused and task-focused relationship. On the other hand, an occasional rough word will not disturb a relationship that produces results and accomplishments for all concerned (pp. 65 - 66).

Delegation of Authority

As the Commonwealth Secretariat (1993) puts it, "Delegation is a process by which managers, such as school heads, transfer part of their authority to subordinates, for the performance of certain tasks and reponsibilities" (p.39). Delegation of authority could be primary or secondary.

Primary delegation. I consider as primary delegation a situation where the head has to perform some task or function himself but which, for a number of reasons, he cannot perform. He will have, in such a situation, to delegate his authority to his subordinate to undertake the performance of the task on his behalf. For example, the head may have to attend a meeting of Heads of Departments, convened by the Dean. The head, at the same time, is scheduled to meet with the Vice-Chancellor at the University of Cape Coast Guest House, Tesano, Accra, for a discussion on some important departmental issues. The head, in such a situation, may have to honour personally his meeting with the Vice-Chancellor and ask a member of staff, usually the next most senior member, to attend the meeting of Heads of Departments. In another situation, the head may be invited by the Planning Committee to give a briefing on the activities of the department for the ensuing year. The head, at the time for the talk, may be extremely busy, trying to complete for immediate submission the budget estimates of the department. The head may, in such a situation, delegate his authority to a staff member to give the briefing on his behalf. These are examples of real

- delegate his authority to another member of staff who is officially not a signatory to the accounts of the department to sign any financial document, including vouchers and cheques.

- In matters relating to direct communication of departmental policy issues with the Vice-Chancellor, the Registrar, the Minister of Education and other such high level officers, the head should not delegate his authority to his subordinates.

- Authority can be delegated but not responsibility. No officer can delegate his responsibility. This means that if the head asks a subordinate to perform a function on his behalf the head still bears the primary responsibility or irresponsibility. Should any query arise out of the performance of the function it is the head who would be held responsible, at least in the first instance, even if it becomes necessary for the delegatee to explain certain issues.

Barriers to effective delegation. It is necessary to discuss certain issues which could act as barriers to effective delegation of authority. That is, for a number of reasons or in a number of situations, the head may feel reluctant to delegate his authority to his subordinates, particularly in what has been termed in this paper as primary delegation. Such situations include the following:

- Where the head is doubtful of the competence of the delegatee. The head has to be certain the subordinate is capable of performing the task in question before the head considers him as an effective delegatee.

- Where the head feels it will take too long a time to brief the subordinate on the task the subordinate is to perform.

- Where the head will not like to reveal certain administrative secrets to the delegatee, that is, where the head has something to hide. This is not a positive approach, anyway.

- Where the head is not prepared to take any risks since he may fear the subordinate may let him down, not on grounds of incompetence but on those of lack of faith in the subordinate's credibility.

- In a situation where the subordinate may perform the task very well, probably much better than the head would have performed. In such a situation, the head may feel his security

might be threatened to make his subordinate undertake the assignment. Many heads refuse to delegate their authority for such a reason but this approach is not a healthy behaviour.

Communication

One important means of creating and maintaining effective working relationship in a department, unit or section of a university is through adoption of appropriate means of communication. Stoner (1978) states that, "managers do not manage in isolation; they can carry out their management functions only by interacting with and communicating with others" (p.466). He defines communication as "the process by which people attempt to share meaning via the transmission of symbolic messages" (p.467). Savage talks of communication as "an exceedingly complex process in which people, behaviour, and objects transmit information, ideas, and attitudes" (in Riches and Morgan (eds.), 1989, p.104). There are many types of communication, the most commonly used in an office being through speech, the written word and body language, also termed as non-verbal form of communication. The head of a department, unit or section or the dean has to adopt the type of communication which may be appropriate for a particular occasion.

The flow of information in the department through appropriate means of communication is such an important aspect that heads have to fully encourage it. It helps members of the department, unit or section to know what is going on in the department, unit or section; what plans the head has for his staff members reqarding the development of important aspects or changes in the University to which the head has had access. Such information may reach the head through his attendance at university-based meetings like the Academic Board Meeting. The head could circulate information to staff members through many means, such as :

- Writing memos on an issue to staff members

- Circulating minutes to members to whom the minutes have relevance

- Photo-copying short pieces of information, which the head may receive, to his staff members

- Calling an emergency meeting for the information or discussion of an important issue demanding immediate attention

- Disseminating information received to members of staff

individually or in groups as they make their appearance to the department; that is, where formal meeting may not be necessary or convenient.

Communication should not be a one-way traffic affair where only the head sends information to members of staff. The head should encourage the flow of information from staff members to him and across the department, from one member to another. It is necessary to point out that the head should encourage the flow of healthy information, the type of information that will help build and develop the department. Pieces of information couched in deformatory reports on members of staff should not be encouraged to be disseminated in the department. Dissemination of such pieces of information is likely to result in creating rancor, hatred, misunderstanding and bitter feeling among staff members which could bring about disunity in the department and retard progress and development.

Leadership Styles

Deans of Faculties and Heads of Departments/Units/Sections as leaders, do adopt different leadership styles. Leadership styles concern the way and manner the Head or Dean takes decisions or issues out instructions to his staff members. There are many styles of leadership

but they tend to be summarised into three basic types which are autocratic style, democratic style and laissez-faire style. All three of them are necessary styles to be adopted by a leader but the adoption of one style or another depends on the situation, occasion or the level of officers/ workers with whom the head works.

Autocratic style of leadership. This is the type where the head does not have to consult other members of staff before he takes a decision. That is, the situation may be such that it is not really necessary to obtain the views of other members on the issue before the head arrives at a decision or takes an action. For example, suppose the Vice-Chancellor writes to Heads of Departments to submit the names, educational qualifications, ranks and salary levels of all the members of each department, the head of a particular department does not have to call a meeting to take any decision on the issue, neither does he have to consult members for these particulars. He can readily submit the information required by resorting to appropriate files. In a similar situation, if the head detects certain weakness in the performance of the junior staff of his department and designs an in-service training programme for them, he may develop the programme without consulting the junior staff with regard to the content of the training programme. In such a situation, the

head is much better able to determine the needs assessment of the junior staff than the junior staff themselves. This type of leadership is so called because since the head takes an action or decision without consulting other members, it gives the connotation of the leader being autocratic. However, when appropriately used, its adoption is just lequitmate, On the other hand, when it is necessary for the head to consult other members on an issue but he fails to do so and takes a unilateral action on the issue and only informs his member, the head is not adopting this style of leadership appropriately. He is then being a real autocrat and his action, if it becomes a normal behaviour, may not be accepted in an academic department.

It must be pointed out that some heads, particularly some managers of private enterprises, could be as ruthless in their leadership positions as may deserve their being called authoritarian leaders. In some cases, the enterprise may be owned by the manager - a sole-proprietor type of business organization - and the manager may resort to issuing directions and commands to his subordinates without necessarily consulting them. It is about such heads or leaders that Adesina (1990) writes "The main characteristics of the authoritarian leader are ruthlessness, selfishness, wickedness, agreed, love of power, and desire to be flattered" (p.149).

Democratic style of leadership. This is adopted in a situation where the head necessarily has to obtain the opinions of his staff members before he takes a decision. In such a situation, taking a decision or implementing an action is not an issue which the head on his own can readily accomplish. The issue has to be discussed, probably at a meeting, formal or informal, and the head will require the advice, suggestions and contributions of his staff members on the issue. For example, suppose the University Hospital Administration writes to the Institute for Educational Planning and Administration (IEPA), through the Vice-Chancellor or the Registrar, requesting the Institute to organize a six-week workshop on some aspects of Management for the senior Nursing Sisters of the University Hospital. In a situation like this, it would be wrong for the head to submit an immediate response to the Hospital Administration through the Vice-Chancellor or the Registrar, informing them that the Institute would be able to undertake the assignment. This is an issue that requires the co-operative decision of the senior members of the Institute. A formal or an informal meeting would have to be organized for a discussion on the issue and

consensus decision arrived at on the issue before the head would write to the Vice-Chancellor or the Registrar, informing him of the willingness of the Institute to undertake the assignment, assuming the conconsus decision was a positive one.

In situations like the one described above, the right approach to decision-making should, in academic departments, necessarily be consultative. Should the head take a unilateral decision on an issue that requires the co-operative decision of members of the department, the head would hardly obtain the co-operation of his staff members.

The characteristic approach to taking a decision on an aspect that requires the consultative views of staff members gives the name democratic to such a style of leadership. It does not mean the head will have to consult his staff members on every issue. In situations like the examples raised under autocratic style, the democratic leader would proceed to taking a decision or implementing an action without necessarily consulting his staff members. The analysis makes it clear that the same academic head could be acting as an authoritarian or authorcratic leader at one time and a democratic leader at another time, depending on the nature of the issue he has to handle. It would be a misconception to regard a democratic leader in academia as one who constantly shifts "the responsibilities of leadership from himself to the group", or one who is "the disappearing leader who depends on the group for initiatives and solutions" (Adesina, 1990, p.150). If he were so, he would not be the right calibre for leadership in academia.

Laissez-faire style of leadership. This is the situation where the Head of Department/Unit/Section allows members, particularly the senior members, a great amount of latitude to pursue their lines of interest or carry on their normal duties without much direction or interference from the head. This is so because the head has confidence in the members and trusts they will carry out their duties satisfactorily without much direction or supervision.

In the University environment, for instance, academic heads exercise the least amount of supervision over their academic staff members. The members are specialists in their domains, competent in the performance of their duties and are assumed to be disciplined. The heads do little or nothing by way of directing or supervising what the members should do. For these reasons, laissez faire style of leadership is most appropriate in the University setting, while it is also adopted to a limited extent by heads of other levels of educational institutions, for example, in polytechnic institutions, secondary schools and teacher training colleges.

Here also, the style takes its name from the sort of *laissez-faire* nature that characterises the supervision and direction of the head over his academic staff members.

Adopting *laissez-faire* style does not mean the head should allow staff members to pursue their own line of action even when they are doing what is definitely wrong. The head should not allow things to go on rocks. The Head of a Department or the Dean of a Faculty would not be an effective leader should he be contented with the situation where "things should be left to sort themselves out" (Adesina, 1990, p.150). If by allowing members of staff to pursue their own lines of action will not enable the department or faculty to achieve the planned goal, the head would come out to direct affairs to make sure the department or faculty is working towards achievement of expected results. The laissez-faire leader would be demonstrating the democratic or autocratic style as well when the situation demands his behaving so. In academic environment, we should not conceive the idea that "the *laissez-faire* leader prefers no action to ensure peace to any action at all" (Adesina, 1990, p.150).

Each of the three leadership styles is sound and its adoption should be positively pursued. The laissez-faire approach should not be conceived as a weak leadership style where the head does not care about what happens to the organization. On the contrary, it is a style that could be adopted to achieve a high degree of merit. The selection of one style or another depends on the organizational environment and the nature of the issue at stake.

Management of Change

In our world of rapid change, brought about by technological development, there is always the need to anticipate change and plan for it. Change can be described as transfer from old to new or transformation of old form to new form or displacement from one place to another or substitution of one item with another (Commonwealth Secretariat, 1993, p.56).

Since old attitudes die hard, change is not easy to come by. It must be planned and it needs patience and perseverance, tact and the eagerness to forge ahead. It also requires the co-operative efforts of all and sundry.

Without change, there could be no development. Heads therefore have to plan ahead and put one step forward each day towards that sort of change that will bring about innovation and development. If we continue to remain in a status quo, we may be overtaken by events, by the strong wind of change that is blowing all over the world. As Drucker (1970) points out "the most

common cause of executive failure is inability or unwillingness to change with the demands of a new position" (p.59). Heads need to plan for effective change in their administrative and academic programmes.

Conclusion

The topic *Principles of Management* is a broad one and only a few aspects of it could be raised in a paper of this nature. The issues treated in the paper are some of those issues which have direct relationship with the functioning of Deans, Heads of Departments and other Heads in a University setting. These issues are, however, generic in nature and could probably satisfy the management needs of heads in other organizations.

In carrying out his management duties, the head has to bear in mind that of all the resources at his disposal, the human resource occupies a central position in all affairs. It is the human capital which is the active resource in all deliberations towards achievement of organizational goals. As Harbison (1973) points out, it is human beings, who manipulate physical resources and form them into finished goods, build organizations, be they social, economic or political, and who plan and implement development programmes in organizations (p.3).

The head has to make sure he motivates the people with whom he works and accords them the reward they deserve. This is particularly important in a University setting where headship rotates among the more senior members of the departments. The head, sooner or later, may become like any other member of the department rather than head, and would like to be treated with a high degree of cordiality. However, the head must not overlook any weaknesses or lapses which he may observe among some members of the department, specialists and competent as they might be. The issues raised in the paper are meant to guide the head to exercise firm and effective management while relating cordially to the human factor in his organization.

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STRATEGIC MANAGEMENT OF SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION (STME)

Martins Fabunmi

ABSTRACT

This paper provides a general overview of strategic management of science, technology and mathematics education, (STME) in developing countries. It examines policy statements on science, technology and mathematics education (STME) and summarises management pocesses required for the strategic managment of this form of education. The paper concludes with a number of recommendations for improving the quality of this form of educaton in developing countries.

Introduction

Scientific, technological and Mathematical (STME) education is acknowledged as the magic wand required for the breeding of scientists and technical manpower needed for accelerated industrial development worldwide. Every nation strives to improve its industrial production capacity, hence the huge investment in scientific, technological and mathematical education (STME). The human capital theorists (such as T. W. Schultz, M. Bowman and Becker) identified a link between investments in education and economic growth. They argued that without the required stock of skills, physical capital accumulation will not be able to accelerate economic growth. This implies that it is the breeding and employment of adequate and appropriate technical manpower that can accelerate economic development.

In most developing countries, a lot of emphasis is put on science, technology and mathematics education (STM). Most national policies on education prescribe a 6-3-3-4 educational system, i.e. six-year duration for primary education, three for Junior Secondary School, three for Senior Secondary School and four for Tertiary or higher education. These policies place emphasis on the teaching of science, technology and mathematics education. In Nigerian Secondary Schools, for example, the core subjects at the J.S.S. level include Mathematics, Integrated Science and Introductory Technology (i.e. Pre-vocational subjects). In the Senior Secondary School, the core subjects include Mathematics, a science subject (at the least one of Biology, Chemistry, Physics) and a vocational subject (at least one of

Agricultural Science, Electronics, Auto Mechanics, Building Construction, Applied Electricity, Home Management, Metal Work, Shorthand, Typewriting, Clothing and Textiles, Foods and Nutrition, Technical Drawing, Woodwork and Visual Art).

In most of the developing countries enrolment in tertiary institutions is lopsided in favour of art-oriented courses, at the expense of the sciences. This is due to historical antecedence. The colonial administrations emphasized this form of education (i.e., liberal arts), because they needed administrators and not technologists for smooth running of the colonies. On attainment of independence, developing nations saw the need for science, technology and mathematics education (STME) . In order to rectify this lopsidedness, available literature suggests that the following be adopted as policy measures:

1. A greater porportion of educational expenditure should be devoted to science and technology, and

2. Universities and other levels of the educational system should pay greater attention to the development of scientific orientation. To this end, more colleges of Technology and Polytechnics should be opened in a bid to improve scientific, technological and mathematical education.

3 The ratio of Science to Liberal Arts Students in tertiray instituions should be fixed in favour of science-based disciplines. In Nigeria, a ratio of 60:40, Science to Liberal Arts students was fixed in the Third National Development Plan (NPE, 1981 : 25). This confirms the importance the Federal Government of Nigeria attaches to science, technology and mathematics education(STME).

In spite of all the emphasis on this form of education, most developing countries suffer from the dearth of skilled professionals in basic sciences, medicine, pharmacy, agriculture, engineering and other science-oriented disciplines. The question remains : *How can Science, Technology and Mathematics Education(STME) be managed strategically* ? In order to be able to answer this question adequately, it is essential to explain what stategic management means.

Strategic Management

In order to understand what strategic management means, it is essential to examine the meaning of management. Below are the three major ways of defining management:

Process-oriented approach

Management is the use of resources, through team efforts to accomplish the organizational goals. It is accomplished by performing the functions of planning, organizing, staffing, directing and controlling.

Sociological approach

Management refers to a class of elites that runs the affairs of an organisation. It consists of two types of classes

a. Top Management and

b. Operational Management

Field of study approach

Management is a specialized field of study which is concerned with how organisations are administered. It consists of the following branches : Planning, Administration, Supervision and Evaluation

In view of these approaches, management is strategic. It is aimed at accomplishing certain goals. There must be some strategies or techniques to be used so as to achieve the set objectives. Strategic management therefore, is the one which is done at the top of the corporate organisation, involving the use of selected techniques, with a view to achieving the set goals or objectives. Management involves, among other things, *planning*. There are two ways top managers discharge their strategic planning responsibilities : Intuitive-anticipatory planning and formal systematic planning. Both are important and should not be underestimated. It must be noted that managers also employ both intuitive management techniques. Strategic managment and strategic planning are very vital to the success of organizations, while formal planning cannot be done without management-intuition.

Strategic management is the major task of the top management. Drucker (1974) summarized the tasks of top management as "the formulation and implementation of stategy", while on the other hand, Bower (1966) claimed that there are fourteen basic and well-known management processes which make up the components from which a management system can be fashioned. These are :

Setting Objectives : Deciding on the activities or programmes in which the educational system should engage and on other fundamentals that shall guide and characterize the educational enterprise such as continuous growth. An objective is typically enduring and timeless.

Planning Strategy : Developing concepts, ideas, and plans for achieving objectives successfully, and for meeting and beating competition. Strategic planning is part of the total planning process that includes management and operational planning.

Establishing goals : Deciding on achievement targets shorter in time range or narrower in scope than the objectives, but designed as specific sub-objectives making operational plans for carrying out strategy.

Developing the institutional philosophy : Establishing the beliefs, values, attitudes and unwritten guidelines that add up to "the way we do things around here."

Establishing policies : Deciding on plans of action to guide the performance of all major activities in carrying out strategy in accordance with the institutional philosophy.

Planning the organizational structure : Developing the plan of organisation - the "harness" that helps people pull together in performing activities in accordance with strategy, philosophy, and policies.

Providing personnel : Recruiting, selecting and developing people - including an adequate proportion of high-calibre talent to fill the positions provided for in the educational plan.

Establishing procedure : Determining and prescribing how all important and recurrent activities shall be carried out.

Providing facilities : Providing the plant, equipment, and other physical facilities required to carry on the educational programmes.

Providing capital : Making sure that adequate financial allocation is made for the procurement of physical facilities and the running of educational establishments, i.e. running capital.

Setting standards : Establishing measures of performance that will best enable the educational industry to achieve its long-term objectives successfully.

Establishing management programmes and operational plans : Developing programmes and plans governing activities and the use of resources which (when carried out in accordance with established strategy, policies, procedures, and standards) will enable people to achieve the set goals. These are phases of the total management process that includes strategic management.

Providing control information : Supplying facts and figures to help people follow the strategies, policies, procedures, and programs; to keep alert to forces at work inside and outside the educational system; and to measure the performance against established plans and standards.

Activating people : Commanding and motivating people up and down the line to act in accordance with philosophy, policies, procedures, and standards in carrying out the plans of the company.

All these processes, without exception, are in one way or another embodied in a comprehensive formal strategic management process.

Strategic Management of STME

Strategic management is basically concerned with the problem of using appropriate management techniques or tactics to achieve the set goals. What then are the set goals of STME?

In developing countries, the goals of Science, Technology and Mathematics Education ought to include the provision of :

- trained manpower in applied science, technology and commerce, particularly at sub-professional grades;

- the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development;

- people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man;

- professional studies in engineering and other technologies;

- necessary skills leading to the production of craftsmen,

the type of education that will enable our young men and women to have intelligent understanding of the increasing complexity of technology.

In developing countries science and technology ought to be taught in an integrated manner in the schools so as to promote appreciation by students of the practical implications of basic ideas (NPE 1981:29). But field reports indicate the current situation in developing countries is far from what is anticipated. Most secondary school students are yet to have access to the practicals expected to be associated with Science, Technology and Mathematics theories. Students are bombarded with all forms of theories. There are very few ill-equipped workshops which are inadequate and not suitable for the practical lessons (Oni, 1992). A number of questions readily come to mind:

How is STME being managed in developing countries?

Science, Technology and Mathematics Education is being managed through what can be termed as intuitive-anticipatory management technique in developing countries. Under this system of management, the top

management relies on intuition and anticipation for vitally all the decisions taken. Educational institutions have grown to be very complex, hence personal intuition and anticipation of managers are not sufficient for running these institutions. Education can no longer be managed through intuitive-anticipatory technique (a technique which enables one person to use his intuition and anticipation to manage an enterprise). Most educational systems have grown to a stage, in which it is no longer desirable for any Secretary or Minister of Education or State Commissioner of Education or a Local Government Supervisory Councillor for Education to apply this technique. The individual intuition cannot sufficiently take care of the increasing complexity of the education industry.

What can be done to rectify this situation?

The answer is obvious: **Strategic Management of Science, Technology and Mathematics**

Science, Technology and Mathematics Education can be strategically managed through the application of the fourteen processes suggested by Bower (1966), and the use of appropriate management techniques. Already, a number of management techniques are being used in the educational sector of different countries.

These include:

• Planning, Programming and Budgeting System (PPBS)

• Management-By-Objectives (MBO)

• Programme Evaluation and Review Techniques (PERT). It is also referred to as Critical Path Analysis (CPA). All these techniques have been successfully used in the industrial sector. They are also applicable in the educational sector.

The complexity of the modern day educational enterprise calls for the adoption of these cost effective and goal-oriented techniques, particularly during economic crisis. The question remains: *How do we apply these techniques to the education industry?*

Only one technique (i.e. Planning, Programming and Budgeting System (PPBS) falls within the focus of this paper, the other two can best be used at the institutional level, i.e. operational level. Management consists of (1) top management, and (2) operational management. Strategic management is the function of top management.

Management has two major units:

(1)   Planning, and

(2)   Administration.

Planning is necessary to ensure efficient allocation and utilization of scarce educational resources, while administration is to ensure organisational effectiveness. Both are necessary if the set goals are to be attained.

It is the function of top management to ensure efficient allocation, and that of the operational management to ensure optimal use of resources. PPBS can be used to ensure both. PPBS is a process by which resources are allocated to specific programmes or activities with a view to achieving desired objectives during a specific plan period.

Conclusions

The following conclusions could be drawn from our discussion so far:

- Most developing nations recognise Science, Technology and Mathematics education as the key to economic development.

- National Policies on education ought to favour the development of STM education.

  Most secondary schools in developing countries do not have workshops and laboratories needed for the teaching of the practical lessons.

- STME in developing countries is being managed through the intuitive - anticipatory technique which ought to be obsolete in a modern economy.

- Strategic management of STME is desirable in modern day economies.

Recommendations

- In light of the global economic recession and the internal crises in most developing countries, the different levels of government should ensure the following:

- Strategic management of Science, Technology and Mathematics education, (STME) and other forms of education the key to development in all its ramifications, i.e. industrially, economically, politically, etc.. Hence STME has to be managed strategically.

- Educational expenditure should be increased, particularly, the expenditure on STME programmes. Appropriate equipment and personnel must be provided.

- There should be greater co-ordination of STME programmes. Adequate and appropriate educational resources (i.e. materials, personnel, curriculum and fund) should be provided in the different educational institutions.

- Greater attention must be given to the use and maintenance of STME material and facilities.

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Brief Reports/ Comments

POLYTECHNIC EDUCATION IN GHANA :
CAREER OPPORTUNITIES

A. Amuzu-Kpeglo

This paper begins with the optimism that the importance of the Polytechnic institution in tertiary education and its role in national development is now seriously unfolding. At the very inception of the Polytechnic and the Workers College in the First Republic, the founding fathers meant very well for the two types of educational institutions. But the best the Polytechnic could achieve in that era was to operate essentially in training students in specific trades and vocations to the City & Guilds Certificate level.

The assumption was that graduates of the Polytechnic would have little or no management responsibility in the world of work. Their technical and professional training was focused mainly on acquisition of shop experience for salaried employment. "Polytechnics before 1993 produced, in the majority, personnel that industry and commerce would classify as operatives at the lower end of the work force spectrum" (Daily Graphic July 2, 1997 p. . 9). Fortunately, today the Polytechnic is

required, and hopefully, being equipped to train highly skilled technicians and middle level management personnel who, given all the opportunities and incentives, will rise to top executive management positions without betraying or forsaking their roots.

The opportunities and incentives we have in mind could best be described as "Career Opportunities" available to the graduate/diplomate of the Higher National Diploma Programme. These are very explicitly detailed out in the Ho Polytechnic Career Prospectus (1997 - 1998) document. The review below follows very closely the career descriptions as outlined by the Ho Polytechnic. In other words, this paper is limited to the career opportunities of the HND Programme as at now available at the Ho Polytechnic. We are yet to examine other career programmes as they exist in sister polytechnic institutions.

The Ho Polytechnic started as Ho Technical Institute in 1968 with the

primary objective of providing pre-technical education to middle school leavers. The Institute became a Polytechnic in 1986 but essentially remained a second cycle institution within the Ghana Education Service. In 1993 Ho Polytechnic was upgraded alongside five of its counterparts in the country into a tertiary institution with the promulgation of the PNDC Law 321. The Polytechnics are now required to provide tertiary education through full-time courses in the fields of manufacturing, commerce, science and technology. They are encouraged to offer courses in technical subjects at the tertiary level, and to provide opportunity for development, research, and publication of research information.

The Polytechnics, with the assistance from collaborating institutions, have designed relevant curricula and training programmes leading to the award of the Higher National Diploma (HND). These programmes are of three years duration and are expected to complete the tertiary cycle of technical education and provide capacity for training of a new breed of graduates who can confidently combine theory with practice and conduct practical field and action research.

The HND Programme in the Polytechnic has a conspicuous advantage over the First Degree in the University. The Principal of Ho Polytechnic states categorically that although the Polytechnic in Ghana today is a tertiary institution similar to the University, "the underpinning philosophy of Polytechnic education and training is different. At the Polytechnic, the curriculum is career focused with emphasis on the acquisition of hands-on practical and entrepreneurial skills". These hands-on practical and entrepreneurial skills as provided by the various schools and departments afford the HND graduate career opportunities which are unique and challenging.

Agricultural Engineering

Agriculture is the economic sector employing the largest percentage of the population of Ghana. Agricultural Engineering is the discipline that provides the mechanical tools for Agriculture.

The HND Programme in Agricultural Engineering offers students sound understanding of the skills, processes and techniques involved in the design, manufacture, operation and maintenance of agricultural machinery. The programme also trains students in agricultural production (crop and animal husbandry), soil and water engineering (including irrigation, drainage, soil conservation) as well as crop storage and processing systems.

The career prospects in this field

are wide and challenging. The graduate will help in the modernisation of production systems through intensive application of agricultural engineering techniques. He will fulfil a wide variety of functions in Forestry (logging), Mining and Agricultural Mechanization.

The Higher National Diploma in Agricultural Engineering puts you on the career path to become a Production Engineer, Hydrologist, Soil and Water Engineer, etc. Specialisation in Post Harvest Technology also qualifies you to work in Food Processing Industries. You may also branch into Water Supply and Sanitation Engineering, Dam Building in Irrigation, Land Reclamation and large-scale civil works.

Electrical/Electronic Engineering

At a time when electrical technology is developing rapidly in the third world, career prospects in electrical engineering are good and increasingly challenging.

Man's processes in modern industry are electrically powered and the working of a electrical engineer is related to the generation and distribution of electricity for power, heat and light. The technician or engineer in this field is concerned predominantly with designing,

developing, installing, fault finding and remedial repairs. Testing of electrical motors, generators, alternators, transformers, transmission lines, cables and switching gear also forms essential segments of electronic engineering. The technician is an integral part of the engineering team and as such is expected to liaise with both the engineer and the artisan.

The HND graduate may be employed in industries and specialist fields such as Radio Communications, Rural Electrification, Digital Systems, Medical Instrumentation and Process Instrumentation Control. The working environment therefore ranges from management and maintenance domains to research and development.

Mechanical/Automotive Engineering

Mechanical Engineering is the most general of all the industry-based occupations as it ranges across every stage of the manufacturing process. The HND graduate in Mechanical Engineering is to be found in all manner of industries: those making steel and bricks, mining and power generating stations, oil refineries and foundries, textile factories, etc. He/ she can find employment as designer in development work, quality control, assembly plants and in management. The Automotive Engineering graduates could pursue such careers

as Service Managers, Field Service Engineers, Automotive Equipment Parts Manager, Transport Officer/ Manager and as a Technology Teacher.

School of Business & Management Studies

Accountancy

The wide knowledge of accounting functions of the HND graduate makes his/her task an important one for decision making and the smooth running of any business concern. The prospects are bright as the graduate may be expected to supervise and direct the recording of general accounting information, analyse and produce the information required for the effective running of a business.

His/her day-to-day duties will depend on the needs of the organisation which will manifest in internal auditing, write-up of books and records, costing systems, wages and salary control systems, statements, budget, etc. The HND graduate can therefore be employed at government departments, educational institutions, private industries, commercial and banking sectors, and private accounting firms.

Marketing

Marketing personnel are responsible for planning the marketing programme implementing the programme and evaluating the performance of the programme. In order to do this efficiently, marketers need to develop expertise in many areas including marketing research, sales analysis and forecasting, advertising, sales promotion, public relations, distribution and the generation of profit. The wide range of responsibilities, with the imperative requirement to travel makes it a demanding yet rewarding career choice.

The HND graduate may be employed as a Marketing Officer in business establishments, central and local government administration, service and manufacturing industries. He/she may also establish his/her own marketing ventures.

Secretary And Management Studies

This exiting and challenging diploma programme allows a Secretary to show his/her creative and innovative abilities, utilizing fully all the advanced functions of computer software programmes. He/she will be very versatile as she will compose her own correspondence, and re-write dictated matter. His/her ability to work without assistance relieves pressure from the chief executive.

Graduates of this diploma pro-gramme are employed in the legal,

personnel, building, financial, insurance and general business sectors. Higher technical computer skills with excellent public relations and communication skills could eventually lead the graduate to become a supervisor or the organiser of the "in-house" human resource development management.

Statistics

The need for statisticians is crucial in both developing and developed countries. Statistics deals with the collection, processing, analysis and interpretation of empirical data for decision making.

The HND programme is geared towards :

(i) training professional statisticians in the requisite skills, techniques and aptitudes needed to carry out various statistical programmes and activities, and

(ii) exposing students to related ancillary activities and skills that are needed to equip them adequately so as to satisfy the data generation requirements for solving challenging developmental problems.

The course also emphasises the acquisition of practical and problem solving skills to enable students to relate theory to practice so that they can play meaningful roles in solving current development problems at the various community levels through designing, implementing, monitoring, evaluating and sustaining development projects and programmes.

The career opportunities in Statistics are wide and diversified in direct response to, and in accordance with the trends of development and job prospects particularly at the community level. Employment opportunities and challenges exist for statisticians with training and expertise in all sectors of the economy and national life such as health, commerce, economic development, social stratification, agriculture, business education, engineering and technology.

Building Construction

The construction industry is a global one and will offer a person the opportunity to work anywhere in the world. Construction activities in Ghana will continue to expand particularly in the real estate industry, providing house and infrastructure for our growing population.

The Building Construction Programme provides general education in building technology. Once a person is qualified, he/she will co-ordinate all the production activities on site. He is therefore

trained to serve as a link between management and site personnel. The course also provides general education in quantity surveying which will enable one to determine quantities and cost of materials and labour required to fulfil a contract according to the plan and specification supplied. As a consultant a person can also offer professional advice and service to clients in a construction company.

The HND graduate can work in the public sector, industry and academic fields where teaching and research opportunities exist. He/she may also work with private building contractors and authorities, District Assemblies and community based organizations.

Hotel, Catering And Institutional Management

Ghana suffers from a great shortage of qualified local chefs, so the hospitality industry (hotels and restaurants) offers career opportunities. A person will be able to develop wonderful recipes and style food (e.g. cakes) as well as ensure quality control. Research development and management opportunities also exist in food processing industries.

If you are smart and dedicated you will not have much difficulty finding a job once you are qualified. This diploma programme will qualify you to take charge of a large industrial unit/restaurant that serves meals to thousands of employees and customers daily or run your own outside catering business, restaurant, canteen or set up recreational centres. There is the opportunity of branching into teaching at the Senior Secondary School and in the tertiary level. You may also be employed in the hospitals as a Diet Supervisor or Catering Manager, and in hotels as Senior Housekeeper or Supervisor.

School of Art and Design

HND Fashion Design And Modelling

A fashion/textile designer is responsible for the creation and development of the design or pattern which is woven, knitted, usually on cloth. Fabrics, Furnishes, and Fashion are turned to life by the Fashion Designer. Ghana expects a booming tourist industry in the decades ahead. There is an assuring lucrative and challenging trade for well trained experts in fashion design and modelling.

The graduate can expect to enter the textile/clothing manufacturing industry or operate private enterprise. Opportunities also exist in the Performing Arts, Film and Television Companies. Talented designers can advance rapidly as avenues exist for

one to enjoy recognition at a fairly early stage. For example, large establishments send competent designers out to shop overseas to select fabrics and trimmings and study fashion trends in the major cities of the world.

Job opportunities exist for graduates in Clothing Production, Productivity, Personnel, Work Study and Training, Quality Control, Administration, Merchandising and other related areas. They can also become Textile Producers, Fashion Designers or Garment Producers. Opportunities also exist for them to teach in Junior and Senior Secondary Schools alongside private business.

In conclusion, it is not idle talk re-assuring the holder of the HND qualification of a secured professional future in either commerce, industry, manufacturing, production, management, research or private enterprise

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PUBLIC RELATIONS SPECIALIST, ANY ROLE(S) IN UNIVERSITY STYLE ADMINISTRATION ?

Christie Okae-Anti (Mrs.)

Introduction

Administration is a human process and a means by which the aim or purpose of an organisation is effected. Basically administration is the same in any given situation, but the aim of an organisation might make the style of administration differ. The Act which establishes a university may be different from other acts in the country and it follows that the university administrator must be prepared for a style of administration evolved directly by the peculiar character of the university (Adamelokun, 1989).

Having made this administrative style clear, one should not lose sight of the fact that universities are growing and so the administrative styles or approaches should also be modified to suit the demands of the present system. It is on this note that one would expect the administration to incorporate into its approach, public relations practices that will enhance the overall structure of the entire university system.

Public relations is an essential component in the administration of tertiary institutions. As a distinctive management function, it helps establish and maintain mutual lines of communication, understanding, acceptance, and co-operation between an organisation and its publics. It involves the management of problems or issues and helps management to keep informed on and responsive to public opinion. It also defines and emphasises the responsibility of management to serve the public interest and helps management keep abreast of and effectively utilise change, serving as an early warning system to help anticipate trends. Additionally, it uses research and ethical communication techniques as its principal tool (Wilcox, Agee & Ault, 1992).

A cursory look at the explanation of public relations given above implies that the purpose of the management function of public relations is to advance the objectives of an

organisation. Public relations programmes must be geared towards the achievement of organisational goals.

Method

A survey was designed to identify ways in which public relations contribute to the management of university education in Ghana, using the University of Cape Coast as a case study.

Employing the questionnaire and interview methods, data were collected from the Deans of Faculties, Heads of Department, Student leaders, Staff of the Public Relations Unit, Registrars of all categories and the Vice-Chancellor. There was the need to find out the responsibilities which were seen by the university publics as most important for effective public relations role in decision-making, university-community relations and effectiveness of communication to the university's publics.

Results

Generally the study revealed that there were varied roles of public relations at the University of Cape Coast: handling of complaints; identifying areas within the community that could benefit from the University's resources and facilities; counselling management

on business issues; developing wide communication network to keep the internal and external public informed; assisting in conducting elections on campus and offering hospitality to university's official guests. It was also found that the Public Relations Unit did not have frequent and easy access to vital communication equipment such as computers, photocopiers, facsimile, which could facilitate their work.

Specific findings in relation to the research questions were as follows:

- The most important responsibility seen by the university publics for effective public relations at the University of Cape Coast was Press/Media relations, that is the responsibility of the Public Relations Unit in providing information to the media as well as other user agencies.

- On the effectiveness of information given to the University publics, respondents observed that communication flow was slow and did not augur well for meaningful decision to be made by the University's publics.

- The registrars and students as well as the Vice-Chancellor welcomed the idea of the Public Relations Officer participating

in decision-making. However, the Vice-Chancellor found it a novel idea.

- On University-Community relations, the Public Relations Unit maintained effective relations by opening up channels of communication for discussion and the setting up of a committee on which the Public Relations Officer is the secretary.

Conclusion

The study revealed that public relations management functions were varied ranging from the handling of complaints to assisting in conducting elections in the University of Cape Coast and that all these management functions were necessary for effective public relations. It therefore calls for a re-formulating of public relations policy at the University so that the Public Relations Unit is seen to be serving the wide variety of the University publics' goals and visions. The unit should be seen to be the nerve centre of the University. Secondly, disparity in views expressed by respondents on the role of public relation in decision-making probably suggests that institutional programmes to prop up public relations might be lacking. Ideally, public relations specialists should attend all important meetings involving the Vice-Chancellor and other administrators, learning the whys and wherefores of decisions and lending counsel. It is only when the public relations specialist participates in decision-making that he could satisfactorily develop action programmes and respond better to questions from the publics. Thirdly good community relations is important since this could promote peaceful co-existence and enhance academic and research work.

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NOTES FOR CONTRIBUTORS

JOURNAL OF EDUCATIONAL MANAGEMENT seeks scholarly papers in :

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2. Articles should be accompanied with an Abstract of not more than 150 words in length, typed on a separate sheet. **Brief Reports/Comments** need no abstract.

3. To ensure anonymity in the reviewing process the body of the paper should bear only the title of the paper on the front page as a means of identification. Authors are to attach to each manuscript a cover page giving the title, authors' names, professional status and/or responsibility post, institutional affiliation and addresses.

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