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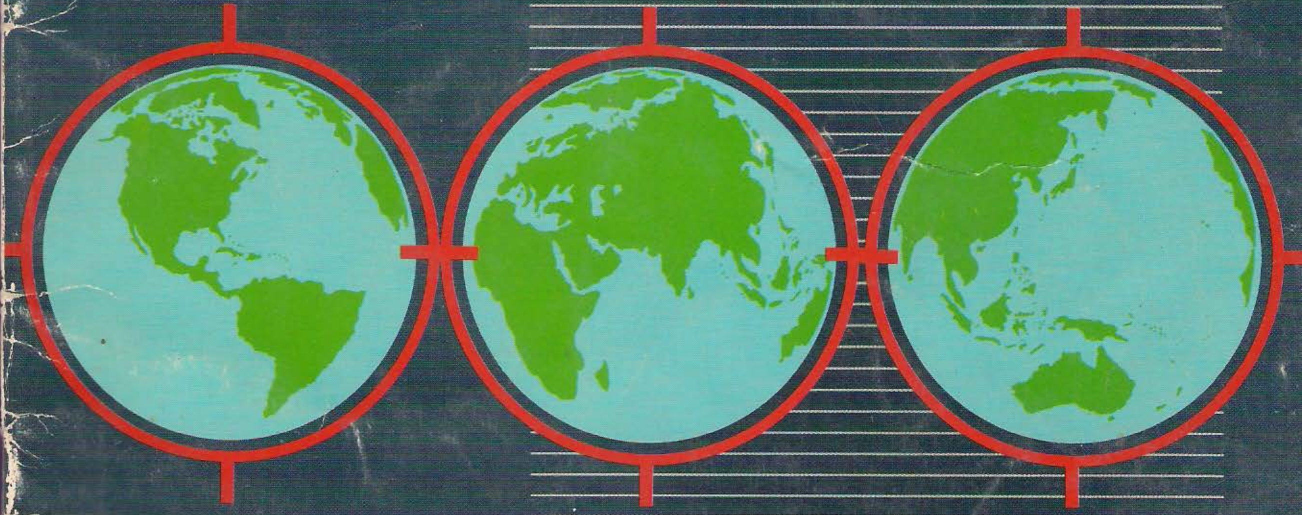

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Curricular Rhetoric Class Teaching and Examinations A Study of the New Nigerian Science Curriculum

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Introduction

Like most developing countries, Nigeria sees rapid social and economic development through a systematic process of scientific manpower training and education, a view closely connected with the effects of the waves of science education reform movements in other countries of the early 1960s.

After political independence from Britain in 1960, dissatisfaction with the emphases of the then existing West African Examinations Council science curriculum designed in the 1950s set in rapidly in Nigeria. As a consequence, a new National Policy on Education was introduced in Nigeria in 1977 based on a 6-3-3-4 format which allocates six years in primary schools (starting from 1977), three years each for Junior Secondary Schools (from 1982) and Senior Secondary Schools (from 1985), and four years for a standard university degree (from 1988). However, the new policy is generally accepted to have started fully operating from 1982 with the Junior Secondary School phase.

The most distinctive characteristics of the new educational system are its orientation towards technical education in the Junior School, and an introduction of a new post-sputnik science curriculum in the Senior School advocating for a 'process' approach to teaching science subjects. These are all characteristics aimed at making secondary education in Nigeria consistent with self-reliance and national development (Nigeria, 1981).

This paper analyses the new Nigerian Senior Secondary School science curriculum against the background of the interpretation of the curriculum in schools by teachers and the abilities tested by new science examinations of the new system. This should enable judgments to be made about whether the examination encourages the development of abilities which the curriculum developers state should characterise science teaching and learning in Nigeria. The analysis should also provide an insight about the extent to which the new science curriculum could be used as an index for future social and economic development of Nigeria through science curriculum development.

Research Procedures

This paper is structured around the findings of the following research questions:

(1) What are the structural characteristics of the new Nigerian science curriculum?

(2) How are science subjects taught in secondary schools under the new curricular guidelines?

(3) What skills do the examination questions of the new curriculum encourage in children?

Three main data collection and analytical strategies were used in the course of the investigation. The first strategy was the analysis of the distribution of performance objectives in three science curricular guidelines (Biology, Chemistry and Physics) issued by the Nigerian government. This was to determine the emphasis of these curricula in terms of their statements of behavioural objectives for all the three science subjects.

The performance objectives in all the three subjects were analysed at the same time for comparative purposes, as well as to show the curriculum developers' relative expectations for each subject according to the three domains of learning - cognitive, psychomotor and affective. The strategy involved counting all the performance objectives stated for all the topics of the three subjects and categorising them according to the leading words used to state each in the domain that best suits the expectations of the objective.

The second research strategy involved classroom observations of science teaching in four Senior Secondary Schools in Kano State, one of the 21 states of Nigeria. This was done through a specially developed observation schedule (after Eggleston 1975, and Alexander, 1974) as part of the field work carried out for a larger study (Adamu, 1988). The aim of the observations was to determine science teachers' interpretation of the new curriculum in practice. A total of 15 teachers were observed teaching 28 Biology and Physics lessons in four senior classes (SS II, equivalent to Form V in the former system) in each school. The observations lasted six months during which 2455 minutes of classroom interactions between teachers and students were recorded.

Thirdly, using the statement of behavioural objectives in the three science curricular guidelines as a framework, the individual examination questions in theory papers of the newly introduced (June 1988) ordinary level Senior School Certificate Examination (SSCE) were categorised according to the skills and abilities the questions appeared to encourage and test. The analysis of the individual questions and sub-questions of the Nigerian SSCE yielded a picture of the general distribution of skills encouraged by the SSCE.

Table 1
DISTRIBUTION OF PERFORMANCE OBJECTIVES IN THE NIGERIAN SCIENCE CURRICULUM

	COGNITIVE DOMAIN				PSYCHOMOTOR	TOTAL
SUBJECT	K	C	A	S		
Biology	119	123	57	24	25	348
Chemistry	52	65	30	5	17	169
Physics	92	56	52	3	38	241
Total	263	244	139	32	80	758

Key: K = Knowledge C = Comprehension A = Application S = Synthesis

Structure of the Nigerian Science Curriculum

A quite striking feature of the new Nigerian science curriculum is its structure. This radically differs from what was used in the country prior to 1985 - which was actually an examination syllabus (WAEC, 1985). In providing the rationale for the structure of the new curriculum, the performance objectives of each topic in the three science subjects were stated in the three broad categories of cognitive, psychomotor and affective domains of Bloom's Taxonomy of Educational Objectives (Bloom et al, 1956). The analysis indicates that the overall distribution of the performance objectives is not even among the three clusters of objectives, as indicated in Table 1 above.

As Table 1 suggests, most of the performance objectives were stated in the cognitive domain, where 263 of the objectives were stated at the knowledge level. This is followed by 244 comprehension items. These two constituted the largest categories of objectives in the cognitive domain as stated in the Nigerian science curriculum. Fewer objectives were stated in the applications and synthesis levels.

Of all the three subjects, Physics appears to be the most practical science subject in Nigeria, since 38 performance objectives were stated with psychomotor achievement in mind. Chemistry turned out to be more descriptive than Biology because only 17 objectives tested the psychomotor domain as compared to 25 in Biology. This, however, is a reflection of the greater number of stated performance objectives in the Biology curricular guideline.

Classroom Teaching Strategies and Emphases

The second level of analysis of the science curriculum involves classroom observations during the teaching of Biology and Chemistry in four Senior Secondary Schools. This is to determine whether teaching science is consistent with the curriculum developers' expectations.

What makes judgment easier is the explicit statement of the suggested teaching approaches for all the science subjects in the curriculum. As further stated in the Physics curricular guidelines, as an example, teachers are strongly encouraged to employ the student-activity based and inquiry oriented mode of teaching (NERC, 1985).

The results of the six month observations of Biology and Physics teaching in four Senior Schools of Kano State in Table 2 below indicate the extent to which teachers interpret these guidelines during class teaching.

Table 2
SCIENCE TEACHING IN KANO STATE SECONDARY SCHOOLS FREQUENCY OF TIME SPENT IN VARIOUS ACTIVITIES

CATEGORY	FREQUENCY	MINUTES DURATION	%
Settling down	45	225	9.16
Teacher talks and introduces topic	37	185	7.53
Teacher talks and reviews topic	28	140	5.70
Teacher talks and expands explanation of topic	266	1330	54.17
Students ask questions	17	85	3.46
Teacher asks questions	15	75	3.05
Teacher refers to text	14	70	2.85
Teacher writes on board for students to copy	55	275	11.20
Teacher demonstrates activity	9	45	1.83
Students carry out activity	5	25	1.01
Class discussion of activity	0	0	0.00

It is thus significant that the teachers' emphases during Biology and Physics teaching in the observed schools differ markedly from the advocated teaching methodology of the Nigerian science curriculum.

This is because, despite the urging of the science curriculum developers to the teachers to use what the developers see as 'inquiry oriented' techniques, about 54.7% of teaching time for the two science subjects was spent by the teachers expanding an explanation of a topic they started almost the moment they came into the classroom. And in all, about 73.3% of class time was dominated by teacher verbal behaviour. Actual student participation in the lessons accounted for less than 5% of the time spent during the lessons.

Emphasis of the new SSCE Examinations

The two stages of analyses done so far provide a framework around which the structure of the examination questions in the newly introduced SSCE could be better appreciated. The result of categorisation of the individual questions of Biology, Chemistry, and Physics theoretical papers of the SSCE into the learning behaviours encouraged by the question papers are indicated in Table 3 opposite.

Thus, although quite a few of the examination items were written to test comprehension, application and synthesis skills, nevertheless the largest category of skills the SSCE would seem to encourage in Nigerian students is knowledge of basic scientific information.

This is because 47.29% of the individual question items in the new Senior School Certificate Examination, which culminates the innovative nature of the new science curriculum in Nigeria, tended towards asking for items that would yield factual information, rather than testing reasoning skills.

Discussion

The analysis of the Nigerian science curriculum using three broad clusters of objectives (cognitive, psychomotor and affective) revealed a very surprising pattern of distribution. For a curriculum with general orientations towards active student participation, the Nigerian Science curriculum would appear to encourage the behaviours it sets out to eliminate during students' learning of science in Nigeria.

This is because the evidence from Table 1 suggests a prime emphasis towards stressing basic scientific knowledge in the curriculum, followed by comprehension skills. Other traits most commonly associated with learning science, and as declared in the rationale of the curriculum, such as the development of reasoning and psychomotor skills, as well as specific attitudes were either not emphasised, or found to a limited degree.

Table 3
DISTRIBUTION OF SKILLS IN NIGERIAN ORDINARY LEVEL SCIENCE EXAMINATION PAPERS (1988)

CATEGORY	FREQUENCY	%
Knowledge	35	47.29
Comprehension	18	24.32
Application	11	14.86
Synthesis	10	13.51
Affective	0	0.00
Total	74	100.00

However, these emphases would seem to be recurrent in cases where attempts are made to make the science curriculum 'pupil oriented' - a character of the newer science curricula, especially in developing countries, where curricular attempts were aimed more at breaking the mould of the traditional world-view.

For instance, in an analysis of the Malaysian Integrated Science curriculum materials whose major intentions were to reduce emphasis on the recall of factual information in favour of encouraging the development of affective, psychomotor and higher order cognitive behaviours, Lewin discovered that despite this intention, "it is surprising to find that 53% of section objectives are specified at the knowledge level of the cognitive behaviour whilst only 18% of general objectives are." (Lewin, 1981)

Generally, the expectation that teachers could implement the curriculum they had had no hand in developing, assumes they are aware of, and agree with, the balance in the cognitive, psychomotor and affective expectations recommended by the science curriculum developers during their teaching. Not many Nigerian science teachers are capable of doing this due to the limited nature of their training. A typical response from a teacher summarises the general situation in Kano State:

"Personally for me there is this question of lack of experience. Sometimes I lag behind as regards the rate at which I go which I know arises because of my lack of teaching experience." (Interview transcript in Adamu, 1988)

Further, many Ministry of Education officials in Kano were not convinced that instructing or requesting science teachers to teach science in a specific way (for example, as suggested in the new science curricula) would be useful. As a government official stated, there would be quite a few problems:

" . . . if you recommend a particular technique (of teaching science) to the teachers, it may not be known to the teachers. You have to realise that in Nigeria today, it is not all teachers who are in the classroom who are actually teachers. They don't even have the basic qualification for teaching." (Interview transcript in Adamu, 1988)

But disparity between what the curriculum developer (or administrator) aims at, and what teachers do in the classroom in implementing the same curriculum is emerging as a standard feature of science education reform, in both developing countries (Lewin 1981; Maddock 1981) and interestingly, in some developed countries such as Canada (Aikenhead 1984; Ste-Marie 1982).

For instance the report of various case studies of observations of science teaching in many Canadian schools revealed that senior-year teachers view science as a precise method and as a system of exact numbers, highly organised bodies of information, and specialized terminology. Their concern is to provide students with the notes and with the practice in solving problems that will result in high marks on examinations and allow the student to move through high school to university (Orpwood and Souque, 1984).

Thus in Nigeria, as in some other parts of the world, the predominance of teacher behaviour reflected in Table 2 casts doubts on any science curricular advocacy that invests more learning independence on the students. This is because such suggested science teaching advocacy rarely takes into consideration the educational realities of the schools - lack of qualified teachers, or facilities or both - as well as the school authorities' concern with covering the syllabus guidelines in the shortest time possible before the all important examination; a strategy which is inconsistent with the new science curricular pedagogy.

Finally, for a new curriculum that advocates a revolutionary perception of science teaching with emphasis on the learner, it would seem that the skills derived from the new curriculum and tested in the learner, lean more towards the ability of the student to recall basic scientific knowledge, instead of encouraging the student to display an understanding of science as a function of greater personal awareness and intellectual development consistent with the stated overall aims of the science curriculum.

And yet one of the rationales given for the development of the new science curriculum in Nigeria is to de-emphasise the power of the examination system on curriculum interpretation by both teachers and students. This is, for instance, indicated in a critique of the former science curriculum in Nigeria (WAEC,1985) by a member of the team that developed the new Physics curriculum who observed that, prior to 1985 when the new curricula were introduced:

"In upper classes of the schools, the topics taught were in obedience to the stipulation of the examination board . . . No proper scientific skills and attitudes were acquired by the students." (Ivowi, 1982)

But although these remarks were aimed at what was considered a redundant curriculum in a rapidly changing society, the same could very well apply to the new science curriculum.

From this, it would seem that the new SSCE was not supportive of the philosophical orientations of the new Nigerian science curriculum. And possibly due to this, teaching science in Kano State Senior Secondary Schools has become rigid, and less imaginative. It also seemed aimed at providing learning experiences directly relevant to enabling the students to pass their examinations.

Conclusions

This study confirms that examinations can exert pressures, albeit hidden, on teachers' interpretation of the curriculum in the classrooms, no matter how innovative the curriculum claims to be. This is significant in the implications it suggests for curriculum reformers and policy makers.

For instance, if a curriculum based on the process/enquiry approach to science teaching is taught didactically, then whatever the students achieve cannot be attributed to the enquiry approach.

This has far reaching consequences. This is because curriculum development in science education usually has strong social and political bases. Consequently science education projects, especially curricular reforms, are expected to result in more people in society knowing more about science and having a better understanding of the nature of scientific work. Often, curriculum development is also expected to encourage more young people to enter scientific and technological occupations. This paper has raised possibilities that the expectations that curriculum development can influence broader social and educational matters in Nigeria may be an uphill task.

Thus it is not enough to merely improve the curriculum by changing its objectives and introducing words with social and developmental dimensions. A whole new range of integrated science curriculum development strategies has to be developed for Nigeria. This should see science education not merely as a list of impressive and politically significant objectives which policy makers and curriculum developers hope will be attained by students, but as a dynamic classroom process which reflects itself both in its statements of intent and in the examination system.

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Communique of the 31st Annual Conference

Science Teachers Association of Nigeria
27 August - 1 September 1990

At its 31st Annual Conference, STAN formulated the following recommendations:

- Nigeria should embark on programs designed to achieve scientific literacy for all by the year 2000.
- Computer education should be introduced at all levels of education as soon as possible after necessary planning. In this connection, appropriate curricula should be drawn up, teachers should be trained and the necessary infrastructure and learning materials should be provided.
- Teachers should adopt a humanistic approach to teaching that will make the learning of STM attractive to the learner.
- STM curricula should be reviewed to ensure that they are based on the environment. STM teachers should also draw examples from their local environment. This will help to improve learning and also demystify science. The use of low cost equipment should also be emphasised.
- A well articulated integrated science program should form the foundation for achievement of scientific and technological literacy for all.
- The pre-service preparation of science teachers should be approached with a greater degree of seriousness than in the past. Serving teachers, inspectors and policy makers should be given in-service training so as to update them.
- All university faculties of education are urged to introduce degree programs in integrated science.
- Education research in STM should be directed towards strategies for improving the quality of lesson delivery as well as strategies for improving learning through problem solving.
- Since the primary school is the foundation level of education, the teaching of science at this level should be strengthened. In this connection, selected primary schools should be provided with good science facilities for the study of STM. JETS Clubs should be introduced in primary schools. Furthermore, JETS production centres should be set up in each local government area, where pupils can carry out projects, fabrications and copy technology.
- Specialist teachers should be allowed to teach science in the primary schools.
- Universities should strive to maintain the 60:40 ratio in the admission of candidates into science and non-science courses.
- A survey of the human and material resources required to attain the targets set for the 1990s should be undertaken within the next year.
- Federal and State governments should speed up the procurement, installation and maintenance of equipment for Introductory Technology.

Incentives in the form of inducement allowances should be given to STM teachers.

- To attain scientific literacy for all by the year 2000, STAN should write simple science supplementary readers and produce the same in the three major Nigerian languages.

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