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ASSESSMENT OF TEACHER NEEDS FOR IMPLEMENTATION OF ZIMBABWE NEW 'O'LEVEL SYLLABUS

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ABSTRACT

The ability and needs of teachers for the implementation of the Zimbabwe Science Syllabus 5006/7 was investigated. The major findings are:

- i. A majority of teachers have difficulties in teaching the following topics: beams, materials, trussed beams, bridges, radio, animal management and animal health - hygiene, natural ecosystem, animal breeding, artificial ecosystem, margarine and glycerol, secondary cells, photovoltaic cells, recycling, sewage, machines and camera.*
- ii. Teachers indicated that they need industrial resources for teaching industrial processes such as ethanol production, the contact process and nitric acid production. Teachers also indicated that they need supplementary readers and modules on nutrition, biological convectors, micro-organisms, and family health.*
- iii. All teachers who participated in this study indicated that they need teaching materials in the form of text books, monographs, modules, charts and supplementary readers.*

INTRODUCTION

Science can be considered as a humane study, deeply concerned with man and society, providing scope for imagination and compassion as well as for observation and analysis. It is not the closed dogmatic system of immutable laws beloved of the nineteenth century positivists.

According to Thier (1980), secondary-school courses were developed to meet the needs and requirements of universities and this greatly influenced both the content of the courses and the style of teaching employed. Science courses were, and frequently still are, considered introducing experiences to the study of university science, and in many schools, particularly in developing countries, science programmes were even more precisely tailored to prepare the students only for a particular university entrance examination.

Traditionally, the style of teaching found in the secondary school was a carbon copy of the all-too-prevalent lecture, recitation, laboratory syndrome characteristic of university courses, with the unfortunate difference that laboratory work was even de-emphasized more than at the tertiary level. In all too many science classrooms, teaching was telling and learning was listening. Such an approach to science teaching has little meaning for much of today's secondary-school youth, who are exposed to important areas such as inquiry and the process of science.

When secondary education was extended to a larger percentage of the population, it became necessary for schools to consider the needs of non-university-bound youth. In Zimbabwe, recognition of this fact and the increasing obsolescence of science syllabuses, together with a feeling that science taught in schools did not reflect accurately the true nature of the discipline and relevance, resulted in the introduction of Science (Zimbabwe) (5006/7). This syllabus, represents a departure from the more conventional approach which studies concepts and principles and then relates them to various industrial applications. The emphasis is on prac-

tical study of the applications of science and technology currently used in Zimbabwe. The syllabus provides an opportunity to make science relevant to the interests and needs of the pupils and the country.

This paper describes and discusses the needs and ability of four hundred form three and four teachers in Zimbabwe. It reports results of questionnaires based on the 5006/7 Science Syllabus.

LITERATURE REVIEW

In Zimbabwe the last nine years have been a time of ferment in the curriculum industry, not just in science but right across the subject spectrum. No discipline has remained untouched - in some cases, all that has been involved has been a general updating and rationalization; in others there has been integrating of traditional subjects, whilst here and there 'new' subjects such as Education with Production, Technology and Moral Education have appeared on the school time-table.

Social changes seldom arise out of simple unitary events and causes nor can relevant features be completely separated from each other. The separation and categorization of causes is purely a matter of convenience and should not be taken to imply that causes are either simple or mutually exclusive. At the same time, it is necessary to consider some of the pressures that have increasingly been brought to bear upon the education system. One of these pressures is egalitarianism, which is one of the Zimbabwean national policies. This implies giving equal access to educational opportunities to all.

The extent and orientation of secondary-science curriculum reform in the last twenty years was summarized by Baez and Alles (1973). Baez and Alles cite such projects as the Physical Science Study Committee (PSSC) and Chemical Education Materials Study (CHEMS) in the United States, and the various discipline-centred

Nuffield 'O' level projects in the United Kingdom. These emphasized an inquiry approach to the subject discipline. Evolving out of this work, they described what they call 'humanistically oriented programmes', which lent themselves to an integrated approach. Many other programmes have been developed which range from the very discipline-centred Nuffield 'A' level courses to the Schools Council Integrated Science Project (SCISP).

Decisions made in developed countries have had very significant effect on secondary education in developing countries which based their educational system on what they understood to be the current situation in those countries. Winter (1970), in his study of science education in Asia, pointed out that one of the greatest problems for Curriculum reform are examinations. The UNESCO Conference (1971) cited external examinations as the major obstacle to the development of science education courses which are relevant to the local situation.

In 'Changing The Curriculum' (1971), a UNESCO Conference emphasized the need for science programmes that are related to the interests and current capabilities of the group of learners for whom they are intended. Lockhard (1980) suggested that science programmes must be developed locally in relation to the problems and opportunities available in a given country at a specific point in its development.

A report of the Conference on 20 years of Science in Africa (SEPA 1980) held in Botswana in 1980 advocated a revolution in the manner in which science is taught. The report stated:

Science should be taught in the way in which scientists operate. It must revolutionize science teaching and not just provide subtle approach conforming to what already exists.

With the triple intake of pupils into Form I and the opening of over 463 new secondary school centres in primary school

premises - the 'upper tops', Zimbabwean curriculum developers in science had little option but to accept the challenge.

The massive expansion in secondary education coincided with the independent concern of curriculum developers in science to review significantly the whole approach to science teaching in the secondary schools. According to Wright (1982 p. 368), the science curriculum developers had been anxious to introduce a form of science which:

- a. was appropriate in terms of cost and level of sophistication of treatment to the economic capacity of the country to support it and to the level of qualification of the teachers who would be available to teach it;
- b. would promote an open-ended pupil-practical-oriented experimental approach to science where the object would very much more be for pupils to draw their own conclusions from their experiments than for them to use experiments merely as means to verify pre-established positions;
- c. would demonstrate that the universal principles of science are applicable in a practical manner to the specifics of any given local situation and have relevance within it. The science taught should be appropriate to, and promote the development of those technologies which were realistically implementable within given localities but which would not, at the same time, deny anyone the opportunity of carrying his or her science education further in other contexts if this was desired.

The rapid expansion in education provided the curriculum developers with an opportunity to short-cut many of the normal procedures required of a programme of innovation. The innovations did not go through the normal Research - Development Diffusion Cycle. No trials were done with the materials. Bolam's (1975) list of factors likely to have a bearing on the success or

otherwise of an innovation, viz., relative advantage competitive strength, feasibility, complexity, magnitude, compatibility etc., had little relevance. All that was available in the 'Upper Top' and newly established rural Secondary Schools was classroom accommodation. There were no science laboratories with basic services, no apparatus or chemicals, and no science teachers. If there was to be science at all, it was to be more or less on the Zimbabwe Curriculum designers' terms. The strategy for implementation, in other words, in terms of Bennis, Benne and Chini (1969) topology, was power-coercive, in a plain and simple manner.

Hawes (1979) has clearly illustrated the fate of many curriculum programmes for Africa which have been designed by urban, middle class developers, who have been unprepared to get out into rural areas and to encounter the real problems on the ground for the actual schools involved. Hawes (1979) has so aptly pointed out that curriculum planning must be done in terms of the political, social and economic context in which it is to operate. The basic philosophy which guided the Zimbabwean Curriculum Developers has been described by Wright as follows:

In Zimbabwe the curriculum developers realized the desperate need to exploit fully the country's economic potential; to foster integrated rural development, to introduce appropriate technologies, to stimulate rural growth points and to conserve natural resources. Science and technology are absolutely vital to such programmes and the schools are the places to lay the important foundations to understanding them. Thus, the form of the science studied in the schools must be relevant to the realities of the area in which the schools are situated.

A Syllabus may have a perfectly sound message to convey and yet fail to get its message across. Gross, Giacuinta and Bernstein

(Gross et al 1971) cite the following factors as barriers to successful implementation of a curriculum innovation:

1. Lack of understanding of the new roles to be played by the teacher.
2. An absence of training facilities.
3. School organization may fail to respond sufficiently.
4. Insufficient physical resources.
5. Inappropriate teaching and learning groups.

Science teachers have multiple responsibilities. They must help students learn some of the important accumulated discoveries of humankind, and they must also help them to acquire skills for the acquisition and discovery of new information. In addition, they must also help students develop more general problem solving communication, and social skills. It is therefore essential to assess teacher needs for the implementation of syllabus 5006/7. *11*

The syllabus is designed to serve the requirements of two examination subjects, namely a Science Subject (5006) intended to be written by all candidates, and an optional Extended Science Subject (5007) to be written by those candidates who intend to study a Science subject or subjects after writing 'O' level. In this syllabus, the emphasis is on a practical study of the applications of science and technology currently used in Zimbabwe. The curriculum has been conveniently divided up into the following five main sections.

1. Science in Agriculture;
2. Science in Industry;
3. Science in Energy Uses;

4. Science in Structures and Mechanical Systems;
5. Science in the Community.

Problem: The problem of this study was in two parts:

- a. Are the form three and four science teachers able to teach the new science syllabus 5006/7?
- b. What do the teachers need in order for them to effectively implement the new Science Syllabus?

THE STUDY

Instruments

Two types of questionnaires were developed - one on teachers' needs and the other on teachers' ability to implement the syllabus. For the needs assessment questionnaire, each of the syllabus 5006/7 topic was accompanied by five responses: Content information, content practical, chart and data, supplementary readers (Supp. Rea.) and industrial resources, given in the same order for each topic. For the ability to implement the syllabus 5006/7 questionnaire, each topic was accompanied by four responses: quite able, able, not sure, need help, given in the same order for each topic. On the questionnaire, teachers were asked to respond to each topic, ticking the response which described best their reaction to the topic.

SAMPLING

For this investigation, stratified random sampling techniques were used. The sampling design consisted of five categories, namely; Group A schools (formally all white, Asian and Coloured), Group B schools (formally all Blacks), registered private schools, rural secondary and Mission Secondary schools. During sampling, consideration was given to variables which were significant to the research. These included sex, teaching experience, qualification and

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age. Using random sampling techniques, 130 schools were selected from the nine education regions of Zimbabwe (see Table 1). A total of 400 teachers, responded to the two types of questionnaires.

Administering the Questionnaire

The researcher administered the questionnaires with the help of three science teachers from each region. The researcher conducted the interviews. The data was analyzed using the SPSS/PC+ package of statistical analysis. The findings were based essentially on completed returns of the teachers responding to the questionnaires and interviews.

Table 1

Composition and Characteristics of the sample Based on questionnaire returns)

Key: Reg = register, Pv = Private

SCHOOL TYPE		A	B	Rural	Reg Pv	Mis- sion	No of Respon- dents
Region	No of Schools						
Harare	10	4	4	0	2	0	31
Manica- land	24	2	8	6	2	6	72
Mashonaland Central	12	4	4	0	2	2	36
Mashonaland East	12	1	4	4	1	2	36
Mashonaland West	6	1	2	2	1	0	19

Masvingo	14	1	2	5	2	4	44
Matebeleland							
North	22	4	10	0	4	2	68
Matebeleland							
South	16	1	0	5	0	2	50
Midlands	14	34	6	2	10	2	44
Total	130	21	40	25	24	20	400

Table 2
Distribution of Sample by Sex

Sex	Number	Percent
Male	346	86,5
Female	54	13,5
TOTAL	400	100

TABLE 3**Professional Qualifications of Subjects
in The Sample**

Professional qualifications	Number	Percent
Grad.C.E./PGDE and B.Ed	81	20,3
T1, C.E. (secondary)	180	45,0
T2, T3, C.E. (primary)	14	3,5
Untrained	125	31,2
TOTAL	400	100

Table 4**Length of Teaching Experience of Subjects in the Sample**

Number of years	Number of Teachers	Percent
Below 1 year	30	7,5
1 to 2 years	88	22,0
2 to 4 years	88	22,0
4 to 6 years	78	19,5
Over 6 years	116	29,0
TOTAL	400	100

Table 5
Age Distribution of Subjects in the Sample

Age range	Number of Teachers	Percent
Below 20 years	10	2,5
20 TO 25 years	132	33,0
26 TO 30 years	149	37,3
31 TO 35 years	24	6,0
36 and above	85	21,2
TOTAL	400	100

Findings

a. On the teachers' ability to implement the syllabus, teachers' perception was that they were able to implement four of the five sections of the syllabus very well (Science in Agriculture, Science in industry, Science in Energy Uses and Science in the Community). Teachers were not confident in implementing section four of the syllabus, namely Science in Structures and Mechanical Systems. In all the sections, teachers indicated topics they were not able to implement. From Appendix C, which collapses Appendix B, the following picture emerges:

In science and agriculture, a fairly large percentage of teachers indicated that they needed more content information on such topics as animal management 64,2 percent, animal health 66 percent, natural ecosystems 64,7 percent, artificial ecosystems 58,8 percent and utilization of resources 61,2 percent. In science and industry, some teachers need help in teaching such topics as soaps and detergents 49,1 percent, margarine and glycerol 52,0 percent, and other industrial processes 48,1%.

In section three - Science in Energy Uses, some teachers indicated that they need help in such topics as photovoltaic cells 58,5 percent, telephone 57,7 percent, radio 64,2 percent, camera 50,0 percent, biogas 48,1 percent and projectors 40,0 percent. In section four - Science in Structures and Mechanical systems, some teachers indicated that they needed content information on such topics as beams 55,8 percent, materials 69,2 percent, nails 79,2 percent, trussed beams 83,0 percent, bridges 81,1 percent and machines 59,3 percent. In section five - Science in the Community - some teachers indicated that they need help on pathogenic worms 42,6 percent, viruses 39,2 percent, protozoa 37,0 percent, bacteria 40,4 percent, recycling 57,4 percent.

b. On the teachers' needs questionnaire, teachers indicated that they need assistance in all of the five areas - content information, content practical, chart and data, supplementary readers and industrial resources. In all the five sections, teachers' needs were supplementary readers followed by content practical and chart and data. There was also need for industrial resources and chart and data for section two - Science in Industry.

DISCUSSION

As of January 1989, the syllabus has now been in the schools for six full terms. Certainly, the syllabus has been received with mixed feelings particularly by some of the former Group 'A' and private schools. From the findings and interviews, there are a number of reasons given by teachers for these mixed feelings. It was apparent that the aims of this syllabus were not well understood. The syllabus itself represents a departure from the more conventional approach which studies concepts and principles and then relates them to various commercial applications. It emphasizes practical applications of Science.

Teachers indicated that they are not able to teach such topics as beams 55,8 percent, nails 79,2 percent, materials 69,2 percent,

trussed beams 83,0 percent, bridges 81,1 percent, Animal Management 64,2 percent, Animal Health - Hygiene 66,0 percent, Energy in Communications - Radio 64,2 percent, Camera 50,9 percent and Telephone 57,7 percent. Most of the teachers involved are graduates of the conventional teachers' training colleges and graduates of the University of Zimbabwe. The conservatism of teachers and their inability to teach some of the sections of the syllabus can be attributed to the academic and theoretical nature of much initial training in colleges and the university. All of the science syllabi at the teacher training colleges do not include topics on Science in structures.

Teachers pointed out that the syllabus lacks continuity and that it does not prepare students for the current 'A' level syllabus. Some teachers felt that the depth of the content is not adequate, and that some elementary concepts which would help the pupils to understand more complex concepts are not included in the syllabus.

All the teachers who participated in this study indicated that they need materials and books. Some of the prescribed books were available on the market almost at the end of the two years of implementation. In most cases these books such as 'Step Ahead 'O' level Science Zimbabwe' and 'Focus on Science 3' were never used by many schools. Many schools in the rural areas have untrained and unqualified teachers. These teachers have indicated that, they need teachers' guides and materials.

Recommendations

- Unless science is presented to the pupils in an interesting fashion it is unlikely that any of the objectives will be attained. The units of work which make up the syllabus must of necessity, therefore, be accompanied by guidance for teachers on methods of teaching likely to arouse and maintain the curiosity and the interests of the pupils.

- The science courses provided in pre-service training should include the sections Science in Structures and Mechanical Systems, Science in Agriculture, Science in the Community and Science in Energy Uses. This would help to make the future teacher confident in his subject field.
- There is great need for in-service training for all the science teachers teaching forms three and four. Such training should start within the school, and its provision should be considered to be a responsibility of both the Headmaster and the Head of the Science Department. It is these two people who have the responsibility for integrating the overall curriculum and the science curriculum respectively. Together they can provide valuable guidance to assistant teachers through staff meetings, and staff seminars. They can encourage staff to take appropriate workshops run by Curriculum Development Unit and other agencies such as the Faculties of Education and Science. These faculties could invite specialists from the various faculties such as Agriculture, Engineering and Veterinary Science. Experienced teachers in the field and college lecturers could also be invited. Such experts could then constitute a team of 'curriculum implementers'. The mobile teacher trainers (MTT), using Hawes topology, would visit each region and mount in-service training at more accessible centres such as high schools or teacher training colleges in that region.
- An evaluation of the new syllabus 5006/7 should be carried out to identify its strengths and weaknesses.
- Supporting material should be made readily available for laboratory work. In order to help the teachers, laboratory manuals should be provided. Textbooks are still a basic source of information in science classes, and when they are used judiciously and with a realization of their limitations, textbooks contribute substantially to the teaching-learning situation. The reference book list for Science Zimbabwe, compiled by the Zim-Sci team should be available to every science teacher.

CONCLUSION

Perceptions of the level of competence in each aspect of the syllabus were clearly indicated by the teachers. Most of the teachers indicated that they are not competent in teaching those sections which are more practical in nature, such as Agriculture, Science in Structures and Mechanical Systems, and to a less extent Science in Energy Uses. Given the variation in teacher quality in schools, their needs for implementing the syllabus vary in content and teaching skills. There is a great need for teaching materials particularly in the rural day secondary schools. Such teaching materials should be pupil-centred. It is pertinent to point out that the provision of teaching materials alone will not ensure success in the implementation of the syllabus. The nature of the teachers using the teaching materials should be taken into account. It is desirable that the syllabus should be critically analyzed, so that any appropriate additions or subtractors could be made.

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