

**AN EVALUATION OF THE IMPACT OF THE
KENYA NATIONAL STUDENTS' SCIENCE AND
TECHNOLOGY CONGRESS ON THE DEVELOPMENT
OF BIOLOGY EDUCATION**

BY

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DECLARATION

This thesis is my original work and has not been submitted to any other university for the award of a degree.

AGUFANA, RICHARD ALFAYO

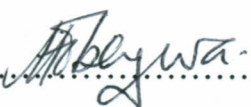
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This thesis has been submitted with our approval as University Supervisors.

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Signature 

DR. HENRY E. EMBEYWA

Signature 

DEDICATION

This thesis is dedicated to my mum, Karen, my wife, Dorothy and our children Karen and Gerry who have been my source of inspiration.

It is also in memory of my friend Gerry E. Wayodi whose parting "instructions" were that I should undertake postgraduate studies.

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ABSTRACT

The Kenya National Students' Science and Technology Congress is a major annual event in the secondary school calendar since its inception in 1963 with the aim of promoting science and technology education application. This study attempted to look at its impact on science education in general and biology education in particular.

The main objectives of the study were to determine the levels of , and factors affecting participation; the role of the congress in the development of biology education; the documentation and dissemination of congress ideas; and congress links with industry.

The study was designed as a survey of Nairobi province and entries made to the national congress between 1985 and 1992, with particular attention paid to the process and outcome of the congress. Comprising the research sample were two national officials of the congress, the inspector of schools in charge of biology, and some selected biology teachers and students from Nairobi secondary schools. The research instruments used included the questionnaires, an interview guide, a document analysis guide, an observation guide and an informal interview schedule.

Findings of the study show that for participants, the congress has improved their biology knowledge, technological capacity, the use of the scientific method, their ability to work together as co-workers, their problem-solving capacity and their motivational orientation. This impact has failed to permeate the secondary school system due to the following reasons. The congress is perceived by many school administrators, teachers and students as an adjunct to the curriculum; teachers and students find it difficult to create sufficient time for the experiential learning that congress participation entails; the school administrators and teachers are so steeped in the didactic mode of teaching that they are unable to guide students satisfactorily through experiential learning; and the perception that the congress does not help in achieving good examination results.

Other findings show that there is poor documentation and dissemination of congress ideas. Also industry has failed to seize the opportunity to develop the prototype ideas emerging from the congress.

The following strategies to resolve this situation have been recommended: development of a better biology curriculum responsive to the country's needs and aspirations; better training and in servicing of teachers; de-emphasis of didactic teaching and encouragement of experiential teaching; de-emphasis of examination-oriented teaching; improved documentation and dissemination of congress ideas; and development of indigenous industries which can stimulate biology and technology education and a strong school-industry link.

CHAPTER 1

INTRODUCTION

1.1. Background to the Study

(a) Biology Curriculum

Biology as a school subject has received increasing emphasis internationally. The approach to teaching the subject has had to change from the didactic kind of study that was initially employed, to an approach that articulates the needs and aspirations of society. Like other science subjects the emphasis previously was on content, the scientific method, excessive belief in objectivity, universality and the cumulative nature of scientific knowledge (Lee, 1967; Jevons, 1969). Thus, the subject was viewed as explanations of nature (Conant, 1951) in which the role of the teacher was to transmit the scientific knowledge as efficiently as possible (Bybee, 1981). Practical work was no more than illustrations of concepts or theories already explicitly presented or taught.

In the 1960s, following distinguished researches in Britain and USA, there were exciting discoveries in such areas as biochemistry, physiology, genetics and ecology, and these led to the encouragement of experimentation. Further, the launching of "Sputnik" into space by the Russians in 1957 increased the momentum of new science curriculum in the United States and triggered a chain of innovations in science education worldwide (Baez, 1976).

The United States of America launched the Biological Science Curriculum (BSCS) project in the late fifties as part of a reform towards a more relevant education. Britain launched the Nuffield Science Teaching Project (NSTP) in 1962. Both BSCS and NSTP marked a shift from traditional science towards learner-centred process-based science. The modern approaches radically transformed the teaching of biology and were demonstrated to be effective (Baez, 1976).

Trends in biology worldwide have been towards exploring man and his relationship with the biotic and abiotic environment emphasising the use of biology in all aspects, and encouraging students to be aware of, and get involved in the decision making process. The trend encourages a learner-centred approach where learners carry out experiments with the teacher acting as guide (Baez, 1976). Although the Sputnik era did not directly affect the science curricula of the developing nations at that time, the new science programmes originating from the United States and Britain gradually influenced the educational science programmes in many countries.

The East African countries were among those influenced by the changes of the late 50's and 60's. The School Science Project (SSP) introduced in Kenya in 1966, is one innovation which was influenced by reforms in the United States and Britain. In the SSP, curriculum developers sought to have a more appropriate curriculum with the good aspects of the new innovations of teaching biology but with content and methodology adapted to the East African context (Koech, 1982). However, lack of coherent implementation policy led to the abandonment of SSP in 1981 (Swift, 1987).

In the recently implemented 8:4:4 system of education in Kenya, biology has also received emphasis as an important subject. Biology is taught with the objectives of making the learner to:

- communicate biological information in precise, clear and logical manner.
- develop an understanding of the interrelationships between plants and animals and between man and his environment.
- apply knowledge gained to improve and maintain health of the individual, family and community.
- make use of locally available materials and information in improving the quality of life.
- relate and apply relevant biological knowledge and understanding to social and economic conditions in rural and urban settings.
- recognise and observe features of familiar and unfamiliar organisms, record their observations and make deductions about functions of the whole organism or its parts.
- develop positive attitudes and interest towards biological sciences and the relevant practical skills.

- demonstrate resourcefulness, relevant technical skills and scientific thinking in familiar and unfamiliar situations.
- design, carry out and evaluate experiments and projects.
- create an awareness of the value of co-operation in solving problems.

(Source: K.C.S.E. Syllabus, 1992).

The latest emphasis in the teaching of biology worldwide has been the application of biology teaching to meet human needs. This has, so far, two objectives, namely, bio-technological development (the application of biological knowledge for industrial and technological purposes) and community development (Atchia, 1986).

(b) **The Kenya National Students' Science and Technology Congress**

In 1963, members of the now defunct Kenya Science Teachers Association (K.S.T.A) responded to the need for practical and process oriented science (including biology) by starting a Students' Science Congress as it was then known, to achieve the following objectives:

(a) to promote science and technology education in Kenya secondary schools, thereby arousing and stimulating interest in the youth in matters pertaining to science and at the same time widening the horizons of students' knowledge beyond that which is received in the classrooms.

(b) to encourage secondary school teachers and students to carry out scientific and technological projects, as outlined in the current science syllabi which aim at emphasizing acquisition of useful practical skills.

(c) to highlight the linkage between science and technology in a technological and rapidly developing country like Kenya and the applicability of the developed technologies in solving everyday problems.

(d) to stimulate and promote creativity, innovativeness and scientific thinking among the Kenyan youth.

(e) to popularise science and technology thereby helping in the establishment of a science culture in Kenya through research projects and publication of student write-ups.

(Source: Documents from the Organising Committee of the National Students' Congress).

The participants at the initial congress were students from schools within and around Nairobi. In 1965 the event became national with wider student participation. Since then the event has continued to be popular as evidenced by the continued increase in the number of schools taking part particularly at district level.

The National Students Congress on Science and Technology organising Committee took over the organisation of the congress in 1989 when the K.S.T.A. was unable to run it. In the same year the name "Science Congress" was changed to "National Students' Congress on Science and Technology". This was because the technical subjects were included among the subjects to be entered for competition. Previously, the competition only covered the following subjects: agriculture, biology, chemistry, home science, mathematics and physics. The venue for the congress has usually been the Kenya Science Teachers College (K.S.T.C.) in Nairobi.

Each year, the National Students' Congress on Science and Technology organising Committee comes up with a theme for the congress. The theme reflects the country's scientific and technological needs. For example, the theme for 1992 was "Science and Technology for National Development".

The organising committees at district and provincial levels are constituted by the Kenya Secondary School Head teachers Association (KSSHA). The members of these committees are all teachers of the science and technical subjects entered for competition at the Congress. The national event is organised by the National Students' Congress on Science and Technology Organising

Committee constituted by the Principal of the Kenya Science Teachers' College (KSTC) at the request of the inspectorate of the Ministry of Education. The committee has fifteen members who are lecturers at KSTC plus a representative from the inspectorate, the National Council for Science and Technology (NCST), and the Kenya National Commission for UNESCO. It is curious why the national universities are not represented.

At every level, entry for participation is limited to agriculture, biology, chemistry, home science, mathematics, physics and technical subjects which include metal work, electricity, power mechanics, building construction, and drawing and design.

The competition for each subject is divided into two categories, namely, exhibits and talks. In the exhibit category, students prepare an explained display of their scientific project work in which they have put extensive as well as intensive research. Creativity and originality are invaluable components in these exhibits. In the talks category, students give a verbal presentation which includes a theoretical background to the project as well as its importance to the society and their findings from research work they may have carried out in any area of science and technology that interests them. The talks may be accompanied by illustrations in the form of charts, cuttings or any other relevant visual aids.

The competition starts at the district level during which winners at position one, two and three in each subject's category are presented for competition at provincial level. The winners at positions one, two, and three in each subject category at the provincial level proceed to compete at the national level. The national event takes place over a period of two days due to a large number of entries for exhibits and talks.

Funding of the congress is both in cash and in material form. At the district and provincial levels, the organising committee receive funds from the students' activity fund on the authority of the Kenya Secondary Schools Head teachers' Association (KSSHA). Donations in the form of books, science equipment and trophies are solicited for from other sources like book publishers, science

equipment manufacturers, sports shops and other firms. The national committee gets the money for organising the national event from the Ministry of Education and other sources, notably, the Kenya National Commission for UNESCO, the National Council for Science and Technology, and up to 1992, the Regional Office for Science and Technology (ROSTA).

To encourage participation in the congress, the National Organising Committee gives science kits annually to under equipped schools. This is done on rotational basis from province to province. The organising committee of the province receiving the kit that particular year identifies the school which deserves the award. The kit is not competed for but is given to schools which participate in the congress.

The national organising committee is positive that the enthusiasm shown by students and schools is proof that objectives for which the congress was set up are being achieved. One of the achievements of the congress is that the humble discoveries made by pupils in their research work for the congress have had a bearing on the large scale technologies developed such as biogas, burglar proof devices, windmills etc. Another achievement is that the medicinal plant extracts obtained by students have gone a long way to show that it is possible to make important scientific discoveries without necessarily having elaborate and expensive equipment. Researchers have been able to get ideas from students' presentations which they can develop.

The committee hopes that in future depending on availability of funds and time, the congress will be diversified to other levels of education like teacher training colleges, primary schools and technical institutes. To enhance popularisation of science, and subject to availability of funds, there are plans to start and intensify workshops, seminars, science resource centres for students, teachers and researchers. The committee recommends that viable students' projects be followed up and developed further by interested large firms. The committee wishes winners at the national congress could take part in international students' science fairs like those held in Ghana, Zambia, Tanzania etc. The committee also wishes to publish a students' science and technology journal based on write-ups on their research projects as presented to the national congress. This is long overdue considering that

the congress was started more than 31 years ago.

It is evident that bio-technological and community development need emphasis. There is need for students to be made adaptable to changes brought about by biotechnology. All these factors underscore the importance of practical work and involvement of learners in solving problems to enhance the quality of life. The National Students' Congress on Science and Technology affords the opportunity for practical work addressed specifically to enhancing involvement in biotechnology and other practical aspects. This makes students become aware of how their intervention through practical work and research can improve the quality of life.

1.2. Statement of the Problem

The role of the Kenya National Students' Science and Technology congress has not been adequately realised as evidenced by inadequate documentation of the practical ideas presented at the congress; and lack of active industrial utilisation of the innovative products exhibited at the congress. Consequently, there is need to determine the impact of the congress on science education in general, and biology education in particular, with a view to synthesizing possible strategies for intervention.

1.3 Purpose of the Study

The study sought to determine the impact of the Kenya National Students' Science and Technology congress on the development of biology education in Kenya. More specifically, the purpose of the study was to determine the extent of school participation in the congress; and the extent to which the products of the congress are utilised in development of the national biology curriculum. In addition, the study sought to establish the degree of industrial utilisation of the congress products.

1.4. Objectives

The main objectives of the study were:-

1.4.1. To explore the extent of school participation in the National Students' Congress.

- 1.4.2. To determine the modes and extent of dissemination and follow up of the congress ideas.
- 1.4.3. To find out how far industries make use of ideas from the National Students' Congress.

1.5. Research Questions

In view of the above objectives, the study addressed the following questions:

- 1.5.1. What types of schools are involved in the congress?
- 1.5.2. What is the proportion of each gender among the student participants in the congress?
- 1.5.3. Do the talks and exhibits impact the trends of teaching and learning biology?
- 1.5.4. How are the new ideas and talents of the congress documented and disseminated?
- 1.5.5. To what extent do industries utilize ideas from the congress?
- 1.5.6. Is there official follow-up on the congress products?

1.6. Significance of the Study

The study attempts to document the innovative components of the congress in order to enhance the growth of biology education at school and industrial level. The study also gives suggestions on how the youth may be better prepared to respond to future challenges through the application of appropriate scientific and technological knowledge and skills. By knowing reasons for participation and non-participation, organisers may formulate ways of encouraging participation in the congress. Similarly the schools and national curriculum developers might become more sensitive to the potential benefits of student involvement in congress activities.

1.7. Scope of the Study

The study covered the Kenya National Students' Science and Technology Congress activities between 1985 to 1992. It focused on those projects that reached the national level.

1.8. Definition of Terms

Biology:

A term referring to the study of the structures, performances, and interactions of all living things, and their relationship with their abiotic environment.

Out-of-Class-Activities:

These are all activities that bring the learner into direct relationship with the environment and are offered on the assumption that direct experiences give reality to the educative process and contribute to the enrichment of the classroom learning. They include field trips, explorations, visits to institutions, science congress, science clubs etc.

8:4:4:

A system or structure of education introduced in 1985. It operates eight years of primary education, four of secondary and a minimum of four years of university education. It succeeded the 7:4:2:3 structure which had a two-year 'A' level (Form 6) programme.

Evaluation:

The process of ascertaining the decision areas of concern, selecting appropriate information, and collecting and analyzing information in order to report summary data useful to decision-makers in selecting among alternatives.

The National Science and Technology Congress:

An event that involves the presentation of innovative ideas in the form of talks and exhibits by students at a national forum.

Technology:

The application of scientific and other organised knowledge to practical tasks.

CHAPTER II

LITERATURE REVIEW

2.0. Introduction

This chapter attempts to look at various facets of science, technology, education, and the National Students' Congress on Science and Technology. A distinction is made between science and technology. Also the interrelationships between science and technology are discussed. The place of science and technology in education is also considered.

2.1. Science and Technology

Science and technology have become part of the world's culture, and any country that ignores this fact does so at its own peril. The practical application of new discoveries in science and technology are the prime movers of the transformation of erstwhile underdeveloped societies of the West into advanced states. These new phenomena were disseminated and proliferated by the West at a fast speed. Thus the West gained a substantial lead over the rest of the world particularly in the 18th and 19th century. In the 20th century countries in the East notably Japan, Korea and Thailand, have joined the ranks of countries which have made great progress in science and technology. The study and application of aspects of science has produced economic and social benefits to mankind guaranteeing a high standard of living and improving the health of the people. Thus science has, in the 20th century, become a necessary aid to good living and good citizenship, to health, agriculture, home making and leisure (Fafunwa, 1972)

Lewin (1986) sees science as endeavouring to understand and determine laws of natural phenomena and in doing so contribute to the growth of knowledge. On the other hand Naughton (1986:6) defines technology as: the application of scientific and other organised knowledge to practical tasks by hierarchically ordered systems that involve people and machines. Thus, technology is concerned with using resources of material, energy and natural phenomena to achieve some purpose related to human needs.

The salient distinction is that whereas the main purpose of scientific activity is understanding "the way things are and why they behave the way they do" (Harlen & Jelly 1989:6), the primary purpose of technology is solving a problem that meets a human need (Harlen, 1987). Baez (1976:17) adds:-

the scientist is driven by curiosity - the longing to know and understand. Other characteristics of the spirit of inquiry include a questioning of all things, a search for data and for relations that give meaning, a demand for verification and respect for logic.

The technologist on the other hand is driven by the desire to translate ideas into working realities (Baez 1976). In this regard Tipping (1986) asserts that technology is not separable from design context and human affairs and it is not an extension of science. "In as much as design and technology are inextricably linked, technology belongs every bit as firmly within the humanities as with science and the arts" (Tipping, 1986:150).

Thus, technology clearly cuts across the curriculum but more than that:

technology often represents conflicting interests, compromises and moral dilemmas. It is almost always controversial and problematic and provides both the opportunity and the context in which pupils can deal with the real controversial issue in a dynamic, evaluative, open-minded and designerly way (Tipping 1986:150).

In practice, there is a close interaction of science and technology. While technology draws a greater deal of its reference from science, much of science has come about as a result of technological development. Neither one necessarily leads to the other, but clearly there is a relationship between them (Tipping, 1986).

It should be noted, however, that the relationship between science and technology is not simple and direct, and is not well understood as many people seem to imagine (Jevons, 1969).

Direct science - technology interaction - in the sense that particular recent scientific discovery finds embodiment in successful technology seems to be a relatively rare occurrence (Jevons, 1969:86).

The distinction between science and technology should thus be noted as much as the influence that the two have on one another should be borne in mind.

2.2. Science, Technology and the National Congress

There are aspects of both science and technology which are pertinent to the Kenya National Students Science and Technology Congress. The scientific investigations undertaken for the congress should meet certain criteria. The investigations should give opportunity for basic concepts or ideas to be developed; interest students and help to satisfy their curiosity, and give opportunities to interact with objects and events around them and so help the students gradually to make sense of their world. They should also give opportunities for children to use and develop investigative skills in testing out their ideas against evidence; and foster scientific attitudes of respect for evidence, open-mindedness and responsibility towards their living and non-living environments (Harlen, 1987).

The criteria to be met by the technology problems include the fact that they should be understandable to students, and they should be tackled in practice by students using simple equipment, tools and materials which are familiar to them. The problems should involve students using imagination and creativity in producing a unique solution, and in the problems there should be a chance of a successful outcome in the time available and within a time span appropriate to the children's attention and concentration span (Harlen, 1987).

Through working on technology problems students must both experience and see that technology is an activity of, by and for the people.

The machine is not the central issue of technology, as many pupils think, but people. Pupils must be able to do things together in technology lessons; do research together, make things together (Raat, 1993: 32).

Technology is an activity of and for everyone and must thus be fascinating, instructive and interesting for girls as it is for boys (Raat, 1993).

The three sorts of skills that technology embraces should be articulated by technology activities in the congress. These skills are, "designing", "making and producing", and "using". "Designing" involves looking for a solution to a particular problem and it is a problem solving activity which relies on creativity. "Making" refers to putting something together. It particularly refers to the coming up with one or a few examples of something during or at the end of a design process. "Producing" on the other hand, refers to making large quantities of the first version of something. As far as "using" is concerned, the product is critically evaluated to see if it fulfils the stated requirements. It is important that the lop-sided over-emphasis of technology as creating of products should be avoided - the "making" must not be separated from the "designing" and "using" (Raat, 1993).

The technology activities at the congress should also enhance the relationship between technology and society. Ways in which technology influences society and vice-versa, should be highlighted in these activities (Raat, 1993).

As much as science and technology can be dealt with separately in the various congress projects, there should be attempts of integrating the two areas. For instance, the projects could endeavour to foster the essential scientific content, skills and processes while at the same time providing opportunities for related technological work. The project work done at the congress should aim more at problem-solving skills, and application of scientific knowledge and understanding to real open-minded problems (Woolnough, 1986; Allsop, 1981).

The Kenya National Students' Science and Technology Congress affords the opportunity for meeting these criteria for science and technology activities. However, this opportunity does not seem to be fully utilized in enhancing biology education.

2.3. Towards Relevant Science and Technology Education

The teaching of secondary schools science in Kenya brings to the fore the dichotomy between school instruction and the students' background. The typical secondary school student comes from a rural background, probably growing up in a simple dwelling with no electricity, running water and other services. Average students are unlikely to proceed to a higher level of education, or to obtain employment in the modern sector of the economy. Only the best students will gain access to the limited places of higher education and employment. The best hope the average students have of serving the country, and obtaining a reasonable standard of living, is by contributing to rural development (Swift, 1987).

Swift (1987) further notes the banking of many parents' hopes on school providing a way out of the poverty trap for the child, who will later be able to support the rest of the family.

Because the aim is to get the children away from the "rural poverty" to the urban "pot of gold" the children are increasingly alienated from rural concerns, duties and skills, even when on vacation. (Swift 1987:55).

The Gachathi Report (1976) pointed out that the syllabuses in operation then were geared towards emphasizing subject matter needed for those who would read science and engineering at tertiary level, and this would at most be 10% of the secondary students. A further 10% would enter the modern sector of the economy and to these a traditional science course might be considered relevant. To the remaining 80% the science learnt at school would be relevant if they could employ it in every day life, particularly in relation to rural development. This was unlikely to occur unless they had experienced such applications of the subject at school (Swift, 1987).

The Gachathi Report (1976) was critical of the lack of relevance of school science syllabi to the country's needs, particularly in regard to rural development. They recommended that the government should localise science content and methodology as a basis for development of labour-intensive technology appropriate to the support of basic activities of life in rural areas (Gachathi, 1976).

The Gachathi Commission was superseded by the Mackay Commission of 1981 which recommended the introduction of the present 8:4:4 system of education whose objective was to lay emphasis on education for self-reliance. Towards the end of 1993 summative evaluation was being undertaken to assess the effectiveness of the 8:4:4 curriculum.

Swift (1987) argues for the increasing of relevance within the "traditional" content oriented courses. He warns against the traditional way of introducing applications of science at the end as a means of showing the practical importance of concepts already learnt because this approach has such weaknesses as the relevant emphasis of the importance of science itself rather than the applications, and the lack of time and stamina available for considering these applications. Instead, Swift (1987) recommends the use of practical concerns familiar to the students, as 'problems' requiring the use of scientific concepts. The 'problem' can be expressed in practical terms as a students' project, or used in context for a written examination question. In the ideal situation, Swift (1987) further suggests without severe time and other constraints, the 'problem' could form the basis of a long project possibly involving visits and out-of-school work, perhaps through the science club.

There are initiatives which have been taken to increase the relevance of school science in Kenya. They include:-

- a) Introduction of new syllabi with increased emphasis on the relevance.
- b) The Kenya National Examination Council has laid an emphasis on rural development as a suitable context for examination questions in the science subjects. For instance in the 1993 Kenya Certificate of Secondary Education (K.C.S.E.) biology theory

paper candidates were asked to explain different methods of food preservation. In this question the candidate had to give the scientific basis for the different methods of food preservation, practised mainly in the rural areas.

- (c) The Kenya National Students' Congress on Science and Technology competition that encourages students to develop projects relevant to rural development (Swift, 1987).

These initiatives still need to be intensified so as to reduce the dichotomy between school science and rural development. The study attempts to shed some light on this aspect, in relation to the Kenya National Students' Science and Technology Congress.

2.4 Links Between School Science/Technology and Industry

Industry impinges on children's lives through for instance, eating packaged food, wearing clothes etc. These facts urge for the study of industry and technology in an approach to education which aims to help children understand the world around them (Harlen, 1987).

Harlen (1987) notes that aims of studying industry and technology have to do with information, cognitive skill development, attitudes, social learning and science - related learning. Pupils are given knowledge of the range of industries, of their link with the learners' lives and what/how technology is used. For cognitive skill development, as industrial processes and technology are studied, an opportunity is availed for promotion of the recognition of the sequence of events, in representation through models, charts and diagrams, in problem solving and higher level skills. The important experience for this learning comes from being involved in technology and making sense of production processes rather than simply learning about these things theoretically.

Negative attitudes that children have are readily changed when they become involved in studying industry especially if they take part in production process themselves. To enhance social learning, visiting industry or inviting workers into the school enables children to see the workers as

people, not as operators who are faceless as machines. The social hierarchy in an industrial concern also begins to emerge. They also realise that the social relationships in industry are just as important as the physical operations therein. As concerns science - related learning, much of what children learn in class begins to mean something in real terms when they see it in operation in the production process.

If it is not possible to have extensive first hand experience of a variety of industries, one alternatively could undertake at least an indepth case study of a local industry. The students would have to be very clear about the basic scientific principles involved, but they would need to see these within a broader framework of other issues. For the maximum use to be made of resources available in a particular country, there needs to be a planned programme of links between education and industry so that students obtain as broad a view of industry as possible (Steward and Towse, 1987).

The Bangalore Conference (1985) noted that "science and technology for industry" is one aspect of "science and technology for the community" since industry is part of the community. It includes a concern for people, raw materials and the final product, and involves solution of human problems. Students should be made aware of this and the potentially symbiotic relationship between industry and the classroom (Holbrook, 1987).

Chambers (1987) notes that at present industries do develop their own training programmes which lack links with the formal educational system. There is a gap between education and industry which needs bridging.

In Britain there is the school - industry movement which is a diverse collection of employer and trade union groupings; specially constructed educational and quasi-educational "projects", government statements and exhortations - "all designed to put pressure on the education system to change both the content of what is taught, how it is taught, and how it is assessed and examined" (Jamieson 1986:209). All these groups have a common interest in seeing schools draw closer to the industrial world (Jamieson, 1986).

The groups vary in motives for wanting to change schools. The government and employers have the concern that schools are not providing young people with the right blend of skills, attitudes and knowledge to maximize their productivity when they need employment (Jamieson, 1986).

That major British companies support a radical revision of the school curriculum to embrace more experiential learning, a greater emphasis on economic literacy, and a more imaginative and relevant assessment system seem rhetorical. This is because there is evidence which is suggestive of the conclusion that employers, like most others working in the schools-industry field, do not have any well founded notion of what sort of education fits the demands of economic efficiency (Jamieson, 1986).

In Kenya the gap between education and industry seems big. The two seem to operate as though they are unaffected by each other, yet in actual fact they could benefit each other. The Kenya National Students' Congress is one forum where perhaps this gap can be addressed and links forged. Industries can further develop the new innovations students come up with while providing incentives and other resources to augment this innovative work.

2.5 Theoretical Framework

In view of what has been discussed above, Black and Harrison's model (1987) on science and technology education has inspired and hence been adopted in this study.

Thus considering biology education, the model has the following components:

SUBJECT	RESOURCES	TASKS	OUTCOMES
Biology	Process Skills Biology Knowledge and Concepts Competence in applying Biology Knowledge of applications	Biology Investigations Find out why Propose and test a model	Full Biological Capability
Technology	Designing Concepts e.g. optimization Technology concepts e.g. efficiency Identification of needs Study of Effects of Technology	Information investigation Find out what and communicate the story	Full Technological Capability
		Technology Tasks Identify a need and construct an optimum solution	

The Kenya National Students' Science and Technology Congress stands in a good position where activities carried out relate science and technology in the process of enhancing scientific and technological capability. The biology projects at the congress therefore have a contribution to make in enhancing biological and technological capability in particular.

CHAPTER III

METHODOLOGY

3.0 Introduction

This chapter presents strategies used in exploring the impact of the Kenya National Students' Science and Technology congress on development of biology education in Kenya. This study was designed as a survey of Nairobi province and entries that were presented at the national congress between 1985 and 1992. The emphasis of the design was on process and outcome of the congress. Attention was paid to participation, that is, levels of participation and factors influencing participation, role of congress in developing biology education, documentation and dissemination of congress ideas, and congress links with industry.

3.1 Research Sample

The sample was composed of two national officials of the National Students' congress; the national inspector of schools in charge of biology; some selected biology teachers from schools within Nairobi, and selected secondary school students within Nairobi.

3.2 Sampling Procedure

3.2.1 Congress officials

The national congress officials were selected using purposive sampling because they were among the most conversant persons regarding the history of the Kenya National Students' Science and Technology Congress. They also had records of the congress entries, adjudication procedures followed, and names of congress sponsors, etc. The national inspector of schools in-charge of biology was also chosen using purposive sampling. The inspector was chosen because of his role in the development and implementation of the biology curriculum, and because the inspectorate is

represented at the various stages of the congress (district, provincial and national).

3.2.2. Secondary Schools, Students and Teachers

A total of twenty four (24) secondary schools in Nairobi were chosen in this study. This is because the other aspects of data collection, that is, interviewing of national officials and analysis of congress documents obtained from the national committee, were based in Nairobi. Thus using schools in Nairobi was to facilitate easier collection of data within the limited means and time available. Stratified random sampling was used in the selection of the schools. The schools were clustered into two categories: those that took part in the National Students' Congress between 1985 and 1992 and those that did not. Twelve schools were chosen from the first category where four were girls' only, four boys and four mixed. Twelve schools were similarly chosen from the second category with four schools from each group - boys' only, girls' only and mixed. The use of the two different categories of schools and the three groups of schools was to help reveal any differences that may exist regarding the perception of the congress goals and activities.

In the schools which took part in the congress, and using systematic random sampling, six students were chosen from each school, three of whom had participated in a biological presentation in a past congress and three who had never taken part in the congress at all. The former group of students was randomly selected from among the entire group of students involved in the biology presentations using the lottery technique, while the latter three students were similarly selected from forms two, three and four with one student randomly selected from each class. Form one students were not involved because of their perceived limited exposure to the National Students' Congress. In each school that has not been taking part in the congress three students, one from forms two, three and four were also randomly selected.

In each of the selected schools, the head of biology was chosen using purposive sampling because of his/her knowledge on policy in connection with the congress, organisation, and participation. Other teachers were selected using the random sampling method. Depending on the

number of biology teachers in the school sampled for the study, one or two or three were selected.

3.2.3 Congress Activities

The researcher attended the 1994 Nairobi Provincial and the National Science and Technology Congress functions in order to gain information on how the actual congress is conducted at the two different levels. The exhibits and talks presented were observed. Informal interviews were conducted to solicit opinions from some participants, audience and teachers concerning exhibits and talks presented.

3.3 Research Instruments

The research instruments used included questionnaires, an interview guide, a document analysis guide, an observation guide and an informal interview schedule. Three different questionnaires were used - one for biology teachers participating in the congress (Appendix A), one for students participating in biology presentations at the congress (Appendix B), and one for students not participating in the congress (Appendix C). The questionnaires were used here due to their objectivity - the respondents are likely to give their responses without any undue influence from the researcher. The questionnaires sought data concerning awareness of, and attitudes towards, the congress; and understanding the status and role of biology and technology in school and society. Opinions were sought on their expectations and assessment of the congress, and the relationship between the congress and the community.

The interview guide (Appendix D) was used to collect information from policy makers (i.e. congress and Ministry of Education officials). This guide allowed the researcher to probe into certain areas with a view to bringing out information that can be cross-referenced with information collected using other instruments. The interview sought information on participation, dissemination and follow-up of congress ideas and school-industry links.

The document analysis guide (Appendix E) was used in the study of available documents. The documents analysed included the congress programmes for the years under study, and the students' write-ups of 1989 to 1992 (these were the only write-ups available). The documents provided information on participation in the congress; gender distribution of participants; dissemination of congress ideas in terms of enhancing biology education in school and the larger community, and the school-industry link. The documents presented a record of entries, list of sponsors etc. of the past competitions, and thus were an invaluable asset in this research.

In order for the researcher to study the products and process of the congress an observation guide (Appendix F) was developed. This guide was used during the Nairobi Province and the National Congresses to aid the researcher in collecting information while observing the exhibits and listening to the talks presented. The purpose of the observation was to get to know the kind of topics presented, how they are presented and the interaction between presenter and audience during presentation.

During both the Nairobi provincial and national congresses, the researcher conducted informal interviews with some head teachers, teachers and students. The questions probed the respondents on various aspects of the congress and its relationship to biology education. These interviews were flexible enough to allow the researcher to get opinions on certain "on-the-spot" issues noticed in the congress.

The different instruments used covered different aspects and different persons involved in some special way in the congress. In this regard, they were expected to give a more complete picture of the various aspects of the congress in relation to biology education.

3.4 **Administration Procedure**

Permission to conduct research was sought from and granted by the office of the President. Afterwards the Provincial Education Officer, Nairobi, issued a letter of introduction to head teachers

of the specific schools that were in the research sample. In the schools, the researcher sought permission from the head teacher who then introduced the researcher to the head of biology. The researcher, with the help of the head of biology, selected teachers and students and administered the questionnaires. Arrangements were then made to collect the questionnaires a week later.

Prior to administering the questionnaires, two schools not among those in the main study were chosen, one school from the category of participating schools, and another one from the non-participating category, for pilot study purposes. On completion of the piloting exercise, the items were scrutinized and the necessary revision made. The final lists of items were then made (Appendices A-C).

The policy makers were interviewed by the researcher using the interview guide (Appendix D). For each one, an appointment was made, the interview conducted on the agreed date, and clarification sought later if it was felt there was need for it.

Documents for study were obtained from the National Organising Committee, Nairobi Province officials and some head teachers and teachers. The documents mainly consisted of programmes giving lists of entries, donors, winners and awards. The documents from the national organising committee also contained write-ups of the students' presentations from 1989-1992. Prior to this period (1989 -1992) no write-ups were available. Among the materials to be analysed was a video cassette covering the 1990 congress. The documents were studied using the data analysis guide and relevant information extracted.

During the Nairobi Province and the National Congress functions, the researcher visited the rooms where the exhibits were mounted and using an observation guide, collected information concerning the exhibits. Similarly the observation guide was used to collect information as the researcher listened to the talks.

Informal interviews were conducted during the congresses mentioned above. These helped the researcher to collect different opinions concerning on-spot issues at the provincial and national congress functions.

The data collected using these different instruments is presented in Chapter Four. A brief discussion basing all arguments on the information obtained from the instruments is subsequently undertaken.

3.5 Field Administrative Problems

There were a few significant problems encountered during the collection of data:

- (a) Some school head teachers refused to allow the researcher to collect data from their schools. Thus instead of using 24 schools as earlier envisaged, the researcher ended up with 21. In spite of repeated visits and requests to some schools, only 85 out of 129 questionnaires administered were returned. This represents a 66% return rate which is statistically acceptable.
- (b) Many teachers were not willing to provide information. In some instances some bluntly asked for a financial incentive before co-operating, a condition that the researcher was unable to meet.

CHAPTER IV

DATA ANALYSIS AND INTERPRETATION

4.0. Introduction

In order to evaluate the impact of the Kenya National Students' Science and Technology Congress on the development of biology education data about participation, enhancement of new knowledge in biology, documentation and dissemination, and school-industry links, were collected from selected education and congress officials, secondary school teachers and students. The analysis and interpretation of the data is presented in this chapter.

4.1. Participation in the Congress

Although the 8:4:4 system of education was introduced in 1985, the last Form Six class of the old 7:4:2:3 system completed their studies in 1989. Thus prior to the 1990 congress, competition was at two levels: O-level and A-level. For the national congress each province had two entries per category (i.e. talks and exhibits) at each level. With the phasing out of A-levels in 1989, the number of entries was increased to three per province.

Table IV-1 shows the analysis of the types of schools that were entered for competition at the national congress from 1985 to 1989 when the last A-level class completed their studies. This table facilitates comparison between O-level and A-level participation. Table IV-2 shows participation from 1990 to 1992, when A-level had been phased out, and thus the congress participants were from the 8:4:4 system only.

TABLE IV-1
Types of Schools Taking Part (1985-1989)

School Category	Gender	Biology				Exhibits			
		1985	1986	1988	1989	1985	1986	1988	1989
O-level School	Boys'	6(40%)	7(54%)	6(40%)	6(43%)	2(14%)	4(31%)	6(43%)	4(29%)
	Girls'	6(40%)	3(23%)	7(47%)	6(43%)	8(57%)	6(46%)	3(21%)	8(57%)
	Mixed	3(20%)	3(23%)	2(13%)	2(14%)	4(29%)	3(23%)	5(36%)?	2(14%)
	Total	17(100%)	13(100%)	15(100%)	14(100%)	14(100%)	13(100%)	14(100%)	14(100%)
A-level School	Boys'	11(73%)	10(83%)	4(36%)	6(54%)	9(75%)	9(82%)	7(54%)	9(64%)
	Girls'	2(13%)	2(17%)	5(45%)	3(27%)	3(25%)	2(18%)	3(23%)	32 (1%)
	Mixed	2(13%)	0(0%)	2(18%)	2(18%)	0(0%)	0(0%)	3(23%)	2(14%)
	Total	15(100%)	12(100%)	11(100%)	11(100%)	12(100%)	11(100%)	13(100%)	14(100%)

Table IV.2

Types of Schools Taking Part in the Congress (1990-1992)

Biology Talks

Biology Exhibits

Year	Boys'	Girls'	Mixed	Total	Boys'	Girls'	Mixed	Total
1990	7 (35%)	10 (50%)	3 (15%)	20 (100%)	11 (50%)	7 (32%)	4 (18%)	22 (100%)
1991	10 (42%)	9 (38%)	5 (21%)	24 (100%)	11 (48%)	10 (43%)	2 (8%)	23 (100%)
1992	10 (56%)	7 (39%)	1 (6%)	18 (100%)	9 (43%)	8 (38%)	4 (19%)	21 (100%)

For all the period under study, the tables reveal that mixed schools had the lowest number of entries. This may be due to the fact that in most provinces the number of mixed schools is lower than that of single sex schools.

Further analysis of the documents showing entrants revealed that girls from mixed schools are poorly represented in congress participation. This problem is persistent for all the years under study. For instance in 1992, 84% of the presenters were male, 16% were mixed sex pairs, and there was no all-female pair. The mixed school seems to heighten their poor self-image relegating them to mere observers rather than active participants (Twoli, 1986).

From the tables it is also clear that A-level girls' schools represented at the congress were proportionally fewer than the boys' schools represented in both categories except in the 1988 talks where girls' schools outnumbered boys'. This may be particularly due to the fact that the girls' schools that were offering A-level science were considerably fewer than the boys'. Further, the ratio of boys' science streams to girls' science streams was 5:1. (Eshiwani, 1985).

The situation is different for the O-level in the 7:4:2:3 system and the secondary cycle of the 8:4:4 system. The girls' and boys' schools compete favourably in the congress. For instance girl entrants out-numbered boys in the biology talks in 1988, and 1990; and in the biology exhibits in 1985, 1986, and 1989. The boys outnumber the girls in other years. The difference in proportion however, is not great. The policy of limited subject specialization at these two levels is beneficial as it encourages girls to study sciences and to participate equally with boys in such activities as the science congress.

The 8:4:4 system has provided a greater access for girls to science education through policies that make it compulsory for students in secondary schools to study a minimum of two science subjects. This makes more girls to participate in the congress. That the successful girls from the secondary cycle proceed direct to university is important in the sense that more of them can now further their education in science-oriented courses. Their involvement in the congress helps to

augment the quality of the science education they receive at school.

4.1.2. Reasons for Students' Non-Involvement in the Congress

Not all students in Kenyan secondary schools take part in the congress due to various reasons. The 45 students who did not make any presentations during the congress were asked why they did not participate in the National Congress. Their responses are summarized in Table IV.3.

Table IV.3
Reasons for Non-Involvement in the Congress

REASONS	N=45	PERCENT
Lack of time	17	38
Lack of participatory opportunity	16	36
Negative self-image	11	24

The table shows that 17(38%) of the students who did not take part in the congress failed to do so due to lack of time, while 16(36%) cited lack of participatory opportunity and 11(24%) showed that it was their negative self-image that led to their non-participation.

These students who cited lack of time as the hindering factor put the blame on the wide biology syllabus they have to cover. They feared that their participation could divert their attention away from the syllabus. Other students stated that they would not want to be associated with shoddy projects from their schools, projects whose poor quality resulted from hurried preparation done within a short time. That students see time as a limiting factor suggests that they consider congress activities as being totally divorced from in-class activities and therefore needing separate time as opposed to integrating them with other class activities. This perception does not augur well for the teaching of biology in a way that is more beneficial to the learners.

Factors militating against provision of participatory opportunity were identified as school policies that limit participation only to certain classes, the science club (through which preparations are usually effected) not being given enough materials and moral support from the school administration. Further information from interviews revealed that some heads of schools prefer more attention - securing activities such as drama, music and games to congress activities and thus promote them more visibly than congress activities. Due to this lack of participatory opportunity the chance to learn biology that students could have got as a result of carrying out congress projects is denied.

The aspects of self-image that hindered participation in the congress were identified as shyness, the belief that the congress is a preserve of those gifted in science, the belief that the work is too difficult for them, and the unavailability of teachers' guidance without which students cannot take part. Such a predisposition is crippling not only to the enhancement of the congress but also insofar as it will make the student not to take full responsibility of his/her own learning.

4.1.3 Attendance of the Congress

Some students may not take part in presenting exhibits and talks at the congress but may have attended the congress at one time or another. Table IV.4 shows the number of such students.

Table IV.4

Attendance of the congress by students not presenting projects

Category of students	Have attended
Students from participating schools N=24	10(42%)
Students from non-participating schools N=21	5(24%)
TOTAL N=45	15
PERCENT	33%

The table shows that a third of the student respondents have attended the congress at one time or another. This represents 10(42%) respondents from schools participating in the congress as compared to 5(24%) from non-participating schools. This shows that participation of a school in the congress enables even students who are not actually involved in making presentations to gain access to congress ideas and thus learn from these ideas. Of the students who have attended the congress, 6(40%) stated that they were impressed by the kind of exhibits and talks presented. The originality and creativity that went into the preparation of the presentations impressed 5(33%) of them. Only one respondent recognised the event as a means of sharing ideas, a fact which is the central theme of the congress, and which all others apparently did not realise. This realisation underscores the impact of exposure to congress activities.

4.1.4 Factors Affecting Participation

(a) **Status of the Congress Vis-a-Vis the Curriculum**

In order to find out why they did not participate, opinions were sought from students who were not involved in making presentations at the congress concerning their perception of the place of the congress in the school curriculum. More than half of the 24 students in the study from participating schools (i.e. 54%) considered the projects as too time-consuming while the rest said the projects were not too-time consuming. Perhaps the way these projects are handled in these schools makes the students to develop the opinion that the projects are just an adjunct to the school curriculum and not an integral part of it. Thus they are seen as an unnecessary burden.

Fewer students from non-participating schools (29%), stated that the projects were too-time consuming. This could be because of their lack of actual experience of how the projects are carried out.

The respondents were asked to give reasons for their observations above. Table IV.5 summarizes the main reasons given.

Table IV.5

Students' Views on time required for congress project preparation.

Reasons	Students from participating schools		Students from non-participating schools		Total	
	N=24	%	N=21	%	N=45	%
With good time management, one can cope	5	21	3	14	8	18
Too much time is taken leading to a lag in class work	10	42	7	33	17	38
Time spent is worthwhile in terms of learning	8	33	5	24	13	29
Un-focussed reasons	1	4	6	29	7	16

The table shows that 17(38%) of the non-participating respondents expressed the fear that involvement in preparation of congress projects would take too much time leading to a lag in class-work. This represented 42% of the respondents from the schools taking part in the congress and 33% of those from schools not taking part.

Only one third of the respondents from participating schools and one fourth from non-participating schools, considered the congress projects worthwhile for learning purposes. This is nonetheless positive in the sense that the congress projects are not viewed as a waste of time by all students. That the proportion is higher in participating schools shows that exposure to congress

projects promotes the awareness of the benefits students can derive thereof.

Also from the table, 18% of the 45 students not involved in making presentations noted that, although they may not have so much time to attend to congress projects due to the heavy curriculum, one can re-organise his or her time to facilitate participation in the congress. This group recognises that in view of the much work one has to do, it is imperative that time be well managed for successful participation. Indeed, good time-management is one aspect that is vital to all students if they have to cover any school work given to them.

(b) The Students' Attitude Towards the Science Congress

The attitude that students have towards the congress affects their perception of the same. Teachers responding to the teachers' questionnaire were asked about the students' attitude towards the congress. Over 80% of them stated that students do not like undertaking time-consuming projects. Indeed 14(70%) of the teachers explained that many students consider the congress as extra work. This reinforces the earlier observation of the congress being seen by students and teachers as an adjunct to the curriculum. In view of the heavily loaded syllabus, these time consuming projects are less likely to be favoured by students and teachers.

Concerning students' response to the congress, 12(60%) of the teacher respondents expressed that in general students were enthusiastic about the congress. Some 20% of the teachers were not sure of how the students respond towards the congress. This reveals that some teachers are not interested in even getting to know what the students' reaction towards the congress could be. The remaining proportion of teachers (20%) pointed out that the students do not respond enthusiastically towards the congress. Further analysis of reasons given by teachers revealed that 35% of them stated that it is only students with a science bias that are enthusiastic about the congress. However 25% of the teachers pointed out that even students without a science bias were interested in the congress. Thus the level of interest may be high among students but the nature of the work involved may be what hinders their actual involvement

(c) Organisation and Management of the Congress

The way the congress is organized and managed affects the level of participation in the congress. Nearly half of the teacher respondents stated that the way the congress is presently organized and managed discourages participation. The teachers identified some obstacles to participation. One of them is the perception that some schools present projects that are out of the 8:4:4 syllabus and still win. The disparity in resources which makes poorly equipped schools not to compete favourably with well equipped ones, was another obstacle. Other obstacles included what teachers considered as biased adjudication, lack of encouragement to small schools in recognition of their efforts, and the lack of follow-up after competition. The teachers also saw an obstacle in the fact that the congress is becoming expensive in terms of the time and money.

Some of the obstacles mentioned are so perceived due to ignorance on the part of the teachers. For instance, there is no justification why the students' projects should be restricted to the 8:4:4 biology syllabus content given the fact that scientific knowledge is dynamic. From observation of students' projects at the national congress, the researcher was of the opinion that students are capable of researching into new areas outside the syllabus and developing projects that cover such areas. Similarly, participants need not come from well-endowed schools to produce a good project; all that is needed is an innovative mind and many things around can become invaluable resources that can be used. Further, the efforts of small, rather poorly endowed schools, are well recognised by the congress organising committee which gives science kits to deserving schools yearly.

Rewards given at the congress could serve as an incentive to encourage participation in the congress. Students who have participated in the congress were asked their opinion about the rewards and 70% of them stated that the rewards were not commensurate with the work put in. Many respondents suggested that the best way to reward participants would be through further development of projects presented at the congress. The fact that the projects are never developed beyond the congress level points to a missing industrial link to the congress.

Information obtained from interviewees showed that teachers are awarded certificates in recognition of their involvement in helping develop the projects presented by students, and in order to encourage continued participation. It may not be very clear how worthy the certificates are in terms of securing promotion. There is need for such efforts by teachers to be recognised by their employer. It is clear that these certificates awarded cannot compare with the rewards that teachers get at the Kenya Music and Drama Festivals. The efforts of music and drama teachers are better recognised and rewarded than those of science teachers involved in the national congress. This differential rewarding calls for increased attention to the role of science and technology in our school curriculum and hence national development.

(d) - The School Administration

The way the school administration views the congress is important in determining the extent of student participation at the congress. That schools in the study encourage participation is a fact that 85% teacher respondents confirmed. Thus there must be other reasons apart from encouragement from the administration that may hinder participation.

The school administration in participating schools provides financial and moral support to make participation in the congress possible. This was explained by 75% teacher respondents from these schools. This contrasted with the non-participating schools where half of the teachers stated that the financial support from the administration was inconsistent or even totally lacking. Thus the administration in these schools could be providing a 'lip-service' kind of encouragement for participation while totally failing to provide the needed resources that would actualise the presentation of projects at the congress.

Regarding whether time is given for students to prepare their projects, half of the respondent participating students pointed out that it was. Some of these respondents pointed out that as the competition nears, participants are made to stay out of class completing their projects while their classmates are learning. This has a potential discouraging effect on the students. Other students felt

that teachers and the administration fail to realise the need for much time for preparing the projects. This feeling was supported by the fact that 95% of the 20 teacher respondents were of the opinion that students should find their own time for congress projects.

This points to a conflict between teachers' and students' perception regarding the place of the congress in the learning process which can be harmful in the development of project work. It also shows that little importance is attached to project work by biology teachers contrary to the emphasis the biology syllabus puts on practical work.

When some of the student respondents who are actually participants in the congress expressed the opinion that there is no need for the school to set aside time for project work since only few students are involved, then it becomes clear that the role of this project work is greatly downplayed. Together with other factors mentioned above, this confirms the earlier observation that congress work is considered by teachers and students as not being part of the school curriculum - biology included.

(e) The Teacher's Role

All the respondent teachers were supportive of the need for teachers and students to develop projects all the time without necessarily waiting for the congress season. They argued that this would help avoid hasty preparations and would sustain interest leading to enhanced learning. They also stated that this would enhance the capacity for developing good projects and positive attitude towards project work as a continuous learning activity, and that many students will be given a chance to share ideas thus expanding their participatory opportunity. This shows that the teachers in fact know the importance of project work. In practice however, most of them fail to play the guiding role that would enable learners use project work to actualize objectives of learning biology.

(f) **Support from Parents**

Interviews conducted with congress officials, teachers and students revealed an interesting factor which encourages participation in the congress. This is the role some parents play. Some of them show a lot of interest in the congress and actually assist their children financially, morally, by explaining some of the ideas, and by providing necessary resources. Parents of Asian origin were particularly singled out to be very supportive of their children's participation in the congress. The reason given by the interviewees for this support was that these parents usually have intentions of sending their children abroad for university education and that these universities give credit for such project work.

The other category of parents singled out was that of parents in scientific fields such as medicine or scientific research. For this group it was felt that it is their desire to share the knowledge in their areas of specialization that prompts their involvement in helping the children. This involvement by parents helps to enhance students' desire to delve deeper into the study of biology which in turn develops their knowledge of the subject as well as the scientific process skills. It also serves as a motivating factor for the students as they realise how important what they are doing is. Above all, it helps teachers, parents and students to work together towards a common goal.

4.2 **DEVELOPMENT OF BIOLOGY EDUCATION**

4.2.1 **Teaching and Learning of Biology**

The opinions of the teacher and student respondents concerning the teaching and learning of biology in high school were sought. The proportion of those who stated that teaching and learning of biology should not just aim at passing Form Four examinations but at broadening students' biology education was 33(73%) of the non-participating students. This compares with 14(70%) of students who participated in the congress and 16(80%) of the teacher respondents.

A further analysis of reasons given to support the answers above revealed that 82% of the non-participating students cited that biology teaching should also prepare students for the future and make biology applicable to their lives. Only 60% of participating students and 13(65%) of all teacher respondents gave the same reasons. Thus more of the non-participating students recognise this reason than the participating ones. The participating students could be less supportive of the reason given due to disillusionment resulting from the lack of follow-up of what they have presented at the congress. This disillusionment does not augur well for the encouragement of project work in learning biology. There is need to re-assert the importance of project work and to have the congress projects followed up as a way of making students realise the role their projects play in addressing economic and social problems.

4.2.2 The Nature of Biology Talks and Exhibits at the Congress

The nature and range of topics covered at the congress is summarized in tables IV.6 and IV.7.

Table IV.6
Topics covered in the O-Level Exhibits
Number of Exhibits/Year

Topic	1985	1986	1988	1989	1990	1991	1992
Utilisation of local materials	6	3	12	12	19	20	17
New techniques in biology	5	3	-	-	-	-	-
Maximum utilisation of plant and animal materials	1	5	-	-	2	4	1
Health	-	1	1	-	-	-	-
Illustration of biology concepts	2	-	-	2	-	-	3
Environment	-	-	1	-	-	-	-

Table IV.7

Topics covered in the O-Level Talks

Topic	1985	1986	1988	1989	1990	1991	1992
Utilisation of local materials	8	5	2	3	9	10	10
New techniques in biology	1	2	3	4	-	4	-
Maximum utilisation of plant and animal materials	-	-	1	-	-	-	-
Health	4	-	4	4	4	6	2
Illustration of biology concepts	-	5	2	3	1	-	5
Environment	4	-	3	-	1	4	4

The tables IV.6 and IV.7 show that the majority of the topics covered in the congress between 1985 and 1992 mainly dealt with utilisation of local materials to manufacture products that would meet certain needs e.g. the preparation of fertilizers, drugs and herbicides. There appears to be some influence from previous presentations which makes students to develop projects along same lines of previously presented projects.

The other topics presented include new techniques in biology where the presentations cover such ideas as how to test for water in milk, how to make artificial colostrum and the irradiation of potatoes. There are health topics covering such issues as abortion, family planning, drugs and AIDS. Presenters also have exhibits and talks tackling how plant and animal materials can be utilized to the maximum. For instance, the exhibits and talks deal with how to make use of parts of plants and animals that are not usually used, to meet specific needs. Some exhibits and talks illustrate and shed light on biology concepts such as acids in the human body, carnivorous plants and evolution. There are also presentations on the environment which mainly cover conservation and pollution.

On the whole, it should be noted that all the exhibits and talks presented represent new ideas (at least to many secondary school students) which in themselves serve to extend frontiers of biology

knowledge. If the ideas are developed for use by the general population, they have the potential of transforming life of many people through problem-solving and minimizing the cost of living.

4.2.3 Congress Projects and Biology Education

On the issue of whether the projects presented in the congress were extra-curricular or related to the examination questions set in biology, 27(60%) of the non-participating student respondents were of the opinion that the projects were related to examination questions. This compares with 11(55%) of the participating student respondents and 9(45%) of all teacher respondents.

A further analysis of reasons given by the respondents concerning the link between the congress and the examinations is summarized in Table IV.8.

Table IV.8

The Link Between Congress Projects and National Biology Examination

	Non-Participating	Participating	
	Students	Students	Teachers
Reason	N=45 %	N=20 %	N=20 %
Projects enhance competence in knowledge and skills	32 71	15 75	11 55
Most presentations are outside the syllabus	0 0	0 0	4 20
No reasons	13 29	5 25	5 25

Table IV.8 shows that 71% of the non-participating students see the congress as enhancing competence in biological knowledge and skills. This compares well with 75% of the participating students and 55% of teachers. The table also strengthens the earlier mentioned conflict of perception of the importance of projects between teachers and students. That 20% of the teachers observed that these projects are not useful in enhancing biological knowledge and skills, was based on their judgement that the work presented is outside the syllabus. This is a dangerous presumption in the sense that whereas the projects may not be directly related to the syllabus topics, they are in fact, based on the very principles covered in the syllabus topics. A critical observation of the students' projects reveals how the principles they have learnt in class are employed. The questions posed to the presenters by judges and the audience always seek clarification of these underlying principles hence making the presentations more instructive and relevant. Teachers who look at the congress from the face value deny themselves the chance of noticing these underlying principles.

It should be noted that students did not pin-point that the projects presented are out of the syllabus. This perhaps is due to the fact that they are not well versed with what the syllabus stipulates. It is only teachers who have this information of the syllabus content.

4.2.4 Congress Projects and the Community

There is a relationship between the congress projects and the community. One way in which this relationship is manifested is in the case where the problems experienced by students in their community provide the inspiration to initiate projects that could address such issues. For three quarters of the student respondents participating in the congress, these problems experienced in the community gave them the inspiration. This congress project - community relationship could be discerned from projects presented at the congress. An observation of the 1994 congress by the researcher revealed that most of the projects dealt with practical problems affecting the community e.g. susceptibility of sukuma wiki to aphid attack, development of animal feed from local materials, and novel ways of controlling the mosquito menace.

The community could also be a source of resources required to develop congress projects. At least 10% of participating students and 15% of teacher respondents pointed out that one need not be discouraged to develop congress projects due to lack of the conventional materials. They suggested that any available resources from the community can be used. This points towards improvisation and seeking resources and help from the community around the school and other institutions like research centres and universities. This is a positive step as participants recognise that with a little ingenuity many materials around them can be used, books from other institutions can be referred to, and resource persons around the school can be consulted.

Whether the students see this congress project - community relationship is important as it will affect their understanding of problem - solving in the sense of realising how the congress projects address community problems. At least 13(65%) of the student respondents participating in the congress recognised that these congress projects were relevant to life situations at the community level. They stated that these projects provide new ideas and skills needed to solve problems in the community, particularly in the home. Also they stated that the projects can help to cut down on costs as they lead to new products that can be cheaper than the ones already in the market. It is a fact that if the exhibits can be developed on a large scale they can be of benefit to many at an affordable cost.

4.2.5 The Benefits of the Congress

Since the congress aims at encouraging innovation, it is important to know whose brainchild the ideas presented are. Table IV.9 below summarises the responses concerning who the initiators of the projects are.

Table IV.9

The Initiators of Congress Projects

INITIATORS

Category of Respondents	Students	Not Sure	Teachers
Non-participating students N=45	21(47%)	14(31%)	7(16%)
Participating students N=20	14(70%)	2(10%)	4(20%)
Teachers from participating schools N=12	8(67%)	1(8%)	3(25%)
Teachers from non-participating schools N=8	2(25%)	1(13%)	4(50%)

From information given in the table above, a majority of students and teachers from participating schools cited the students as the original source of congress projects. From interviews conducted, students pointed out that where the teacher initiates and sets up a project, students learn very little from such a project as they do not fully identify with it. This agreed with the teachers' contention that if they identify and develop the projects, students do not put in their best effort as they regard the projects as the teachers' and not theirs.

The table also shows that a majority of teachers from non-participating schools (50%), think that the congress projects are initiated by teachers. This could be a manifestation of ignorance borne out of their non-participation. They simply don't know how the actual development of the projects takes place and hence presume that it is only teachers who can come up with good projects. In such a case where a teacher believes it is the teacher who should develop congress projects, when he is not innovative or interested then no project will be developed. Yet there may be many students with ideas that can be developed if only an enabling environment is created for the expression of these ideas.

The large number of students from the category of non-participating students, i.e. 31%, who are not sure who should initiate the projects may be an indication of ignorance concerning the congress and lack of exposure to congress projects on their part. Consequently, there is need for students to be informed about how to set up projects. Students' self-image also needs to be boosted so as to start perceiving themselves as individuals who have ideas that can be developed.

Asked whether the presentations are related to objectives defined in the current secondary school biology syllabus, 55% of the teachers responded in the affirmative while, 35% were not sure, and 10% thought they were not. This proportion (45%) of teachers closely matches that of 40% who were earlier mentioned to have considered the project presentations to be outside the syllabus. It shows that many teachers are apparently not aware of the objectives of teaching biology in the first place. It should be noted that the presentations are in line with the objectives in the syllabus which include making the learner to:-

- *relate and apply biological knowledge and understanding to social and economic conditions in rural and urban settings.*
- *design, carry out and evaluate experiments and projects.*

(Source: K.C.S.E. Syllabus, 1992).

When asked for reasons to support their responses on the relationship between the presentation and the objectives in the biology syllabus, many teachers showed that they based their determination of whether the presentations conform to syllabus objectives on whether the topics covered appear in recommended textbooks. The textbook appears to have replaced the syllabus as the teachers source of information on what is to be taught. This trend is dangerous because the two types of documents (the syllabus and the textbook) are inconvertible and "there is no single textbook that can satisfy the syllabus in any subject" (Gacegoh, 1990: 79).

The teachers were also asked the role other subjects play in the development of the exhibits and talks. The majority of the teachers (60%), stated that other subjects have a role to play. They

cited the fact that the exhibits and talks involve day to day lives of ordinary Kenyans whose environment is geographic, economic, historic, cultural, ethical, etc. Thus the teachers underscored the need for consultation among all teachers to ensure good presentations and so as to dismiss the erroneous impression of compartmentalisation of knowledge brought about by subjects. However, some 20% of teachers could not see how some of the subjects could be related to the biology projects.

Opinions were also sought on whether the congress had an impact on the nature and choice of teaching strategies in biology. Those teacher respondents who thought the congress had an impact were 8(40%), while 8(40%) were not sure, and 6(30%) disagreed that the congress had that kind of impact. The reasons cited for impact were that the congress helps boost interest in the subject and can prompt the teacher to re-evaluate his methods. Those who do not see the congress as having any impact reasoned that the presentations were not in line with the syllabus. This reasoning is based on ignorance as the presentations are actually in line with the syllabus as mentioned earlier. Teachers who fail to capitalise on the benefits of the congress do so out of ignorance. That only a few teachers attend the congress, and that this lessens any impact the congress would have on teaching strategies, was cited by some teachers.

The teachers' responses thus reinforce the finding that the congress is considered as an adjunct to the curriculum. Also, they bring to the fore the attitude by teachers that, 'there is not much anyone can learn from the congress, after all', and hence not much consideration is given to participation in it.

The project method is greatly used in the development of congress exhibits and talks. This method involves assigning learners tasks which they have to perform over a period of time. These tasks are to be performed by pupils either through carrying out practical investigations or collecting information from various sources. What is presented at the congress should therefore reinforce the usefulness of this method of teaching. The method can remedy the boredom of traditional teaching-learning approach and the weakness of classroom lecturing by adding interest to the course and

correlating biology to everyday life. In addition project work has the following benefits:-

- not only does it make learning active rather than passive but it also makes the learner responsible for his/her own education.
- it permits and encourages the learner to investigate and broaden his/her education beyond the conception of his/her teachers and giving scope to originality.
- it permits a learner to look more deeply into a field of knowledge.
- it offers opportunity for a student to prepare for further research work.
- it should provide a link between biology studied at school and industry.

(Source: Documents from the organising committee of the National Students' Congress)

Since 40% of the teachers are not sure of the impact of the congress on teaching strategies and 30% of them rule out such impact, it appears that the congress has failed to act as an agent in catalysing the use of the project in teaching.

Nearly all the participating students acknowledge that the preparation of congress projects spurs them to read widely. They explained that this is because the projects cause them to develop the desire to find out the truth and to improve the capacity to answer questions during presentation. Thus the congress helps to improve the biological knowledge of the individual and consequently, that of those who listen to his/her presentation.

The project work undertaken by students as they prepare for the congress gives them an opportunity to learn and apply the scientific method which is a necessary tool in acquisition of further knowledge in scientific disciplines, including biology. Nearly all the teachers surveyed (95%) recognised that the congress project work makes pupils to employ this scientific method. They reasoned that students are employed in undertaking systematic work in which they set hypotheses, design the method of collecting data and present the data methodically. This should be encouraged.

There are benefits in terms of learning, that accrue from students interacting and working together, and 95% of the teacher respondents stated that congress projects give students this opportunity to interact and work together. They explained that the projects enable the students to discover their strengths, and that their self-confidence is boosted. Also students with similar interests are brought together, and collective research and effort are encouraged.

It is important to build the students' interest in the subject so as to facilitate learning. The majority (95%) of participating students surveyed stated that the congress projects they undertook made learning of biology interesting, leading to a higher motivational status. Nearly all the participating students surveyed also stated that their manipulative skills were also improved by the preparation of congress projects. Involvement in the development of congress projects therefore, has an impact on development of the cognitive, affective and psychomotor domains of learning biology.

4.3 Documentation and Dissemination

During the congress many new ideas are exposed. There is need for proper documentation and dissemination of these ideas. An analysis of documents, and interviews conducted with congress officials, revealed that documentation and dissemination of congress ideas has been very poor in the sense that it is only in the last five years of the 32 year-old congress that some write-ups of the past presentations are available, and no form of report is circulated after the congress to publicise new ideas. Prior to 1989 presenters were not required to hand in write-ups of their projects for documentation and dissemination. Thus for this period there is no record in writing, of the nature of presentations that were made. From 1989 presenters were required to present a write-up of their projects. The congress organising committee had intentions of editing these write-ups with a view to producing a magazine. A start in this direction was made in 1990 but up to date(1995) no document has been produced. The organising committee blames this inability on the lack of finances. A decision has now been reached that Kenya National Commission for UNESCO prints the 1990 write-ups and subsequently seeks ways of printing other write-ups.

A study of the write-ups available reveals rather poor report-writing skills by the student presenters. In many reports, for instance, the content is not accurate, the procedure of the scientific investigations done is not clearly explained and the data collected is not presented in a style that would enable the reader to use with ease. Below is an excerpt of such a write-up.

Introduction

Third world countries incur a lot of cost to meet importation of drugs. Traditionally, our grandparents had medical knowledge that helped them cater for victims and unfortunate patients. On conducting a thorough research we found that imported drugs contain similar ingredients and elements as ones within our locality. It was safe and almost at no cost to produce a local herb utilizing local resources i.e. Lemons and Honey.

Procedure

- Take was lemons (Removes dirt and contamination)*
- Keep in cool place. Cover (Lowers multiplication of organisms)*
- Warm before dispensing*

Confirmatory Tests/Chemical Analysis

- 1. Proteins - millions reagent add to a sample portion of the mixture of Lemons and Honey - violet mass.*
- 2. Vitamin C: add DCPIP to the mixture - Decolourised*
- 3. chloride ions: add AgNO_3 to extract - add Dil HNO_3 A white precipitate*
- 4. Reducing sugars - Dil HCl - warm NaHCO_3 plus Benedicts - Blue - Green - Orange - Brick red*
- 5. Sodium ions - Nichrome wire - Dip in concentrated HCl - burn/Heat - Dip in extract - Golden Yellow flame.*

Curative Effects of the Drug

- As antiseptic - Chances blood clotting as the extract.*

- *Lemon juice contains Ascorbic acid - hence acidic medium which is unsuitable environment for micro-organisms multiplication.*

FOR FOOD ALLERGIES

- *Most people have - hypersensitivity to certain foods e.g. sea foods like lobsters, crabs, snails etc*
- *Taking the drug before a meal of sea food sharpens or gives appetite, Hence the meal is comfortably taken (one yearns for more)*
- *On taking the meal sip another dose to act as a digester, hence a patients fear is removed.*
- *Lemon juice is applied on the lesions, swellings, etc. As an acidic medium germs multiplication is kept minimal.*

Economic Importance

1. *Non-irritating, non-toxic and self-sterile.*
2. *Low cost of production since resources are locally available (lemons from farmers and also honey).*
3. *Cheap and curbs exorbitant prices of drugs.*
4. *Boosts living standards of citizens.*
5. *Employment which is of acute need.*
6. *Supplements incomes.*
7. *It's of high nutritive value.*
8. *It's multipurpose because it be used as a cosmetic, for bed wetting, coughs among others*

This weakness needs to be addressed by teachers and the congress organisers since report writing is part of the skills which should be developed by the congress, and also good written communication will make work easier for the editors. In the opinion of the researcher, lack of finances should not limit the dissemination of such ideas presented at the congress. It is important that ways and means be evolved of helping disseminate the innovative ideas developed by young biologists. If need be, a number of well selected companies can be approached for funding with a proviso for advertisement of their products.

Many speakers at past national congresses have lamented the failure of the general public being informed about congress ideas when our country's development is hinged on a science and technology-based development. They note that though current 8:4:4 syllabus encourages a practical approach, research and imagination, this culture is however lacking and needs to be developed. In the words of the Chairman, National Science Congress, 1982:

We — must bring about a widespread understanding of science among the entire population if they are to form a sound base for a modern technological society.

There should be a form of science teaching that can bring about this widespread understanding of science so as to meet the need for widespread scientific literacy among the entire population of a technological society. Experiential learning partly effected through project work can help in this regard. Hence the need for ideas in the congress to be properly documented and disseminated.

The Ministry of Education has a role to play in this aspect of documentation and dissemination. Information from interviews with officials from the inspectorate division of the Ministry of Education revealed that the division sends a team of inspectors annually to the National Congress to observe and select good projects to be taken for display at the annual Agricultural Society of Kenya (ASK) Nairobi International Show. This kind of dissemination is however limited in the sense that only a few members of the public have a chance of seeing these displays. There is need to find ways of reaching many more people. There is a danger however, of interested parties pirating new ideas developed by students. This calls for a concerted effort by the organising committee and the Ministries of Education, and Research, Science and Technology to provide the necessary protection.

4.4 Links with Industry

The existence of a science congress-industry link is of great significance especially regarding the application of science and technology in society. A large majority of the participating students in this study (80%) envisage a link where opportunities for employment in industry could be availed

for outstanding students in the congress to encourage greater participation in the congress. These students were of the opinion that the practical knowledge and skills they have due to their participation in the congress could help them make a start in a career in industry.

Though a majority of the respondent teachers recognised that some concepts learnt in biology are related to processes undertaken in industry, 15% were not sure of this relationship while another 15%, did not see any relationship between the biology principles and processes in industry. In reality there are many biological concepts and principles that are applied in certain industries e.g the use of micro-organisms in production of alcohol, and the manipulation of plant hormones in crop production. Teachers need to realise this and give much emphasis to this aspect so as to improve the school-industry link.

To the proposition that industry can make use of the projects presented at the congress, 19(95%) of the teachers surveyed agree. They reason that industry can harness these ideas and develop new products while at the same time stimulating student innovation.

The students and teachers thus conceptualise a strong school-industry link in which they clearly identify the role of the school and that of industry. Industry however, does not show much recognition particularly of the congress projects. Information obtained from interviews and document analyses revealed that industries have a minimal association with the science congress, the best avenue through which school-industry links could be forged. Apart from donating trophies, something which they do only once in a while as the need arises, no other kind of support is given. It is only a few industries that are on record for providing this kind of support. These include the Kenya Breweries Limited, May and Baker, and the Caltex Oil (Kenya) Limited.

One of the exhibits presented at one of the congresses was an illustration of pesticidal effect of the neem seeds. The neem tree is highly regarded by many Kenyan and Asian communities as having the potential for treating many diseases. The presenters showed that the plant has pesticidal properties. Such leads could be followed by industry with a view to developing a pesticide that can

be useful and affordable. However, to-date (1995), no industry in Kenya has taken up this challenge. There are many such exhibits that face the same fate of non-development by industry.

When considered from a wider perspective, this apparent indifference by industries regarding congress projects is hardly surprising. According to the Daily Nation editorial of February 15, 1994, industries in Africa hardly take interest in what African researchers are doing in the sense that they rarely invest locally in long-term research projects that could improve their products. One problem is that many of these industries are foreign-owned and engage in little transfer of technology by investing in local research. Most of the products they produce are already developed in parent companies overseas. The local subsidiaries simply either assemble or package the product. Thus pharmaceutical companies for instance, hardly develop local drugs. They import patented products and raw materials.

There is need for the development of local industries which may break away from this insensitivity so as to encourage the emergence and fruition of indigenous ideas. However, if local industries have to survive and join the export market, they have to improve their efficiency and quality of goods. They cannot do this without the proper application of science and technology. Neither will agriculture, the mainstay of most African economies, improve output and quality of produce without application of modern methods of farming. That calls for more research (Daily Nation, Op.Cit.). Indeed as Professor Thomas Odhiambo recommends in the First World Science Report, 1993.

for Africa to liberate itself from a pedestrian agrarian and subsistence economy to a vibrant, mixed agribusiness and industrial manufacturing economy, there must be expenditure and production of scientists and development researchers.

(The Standard, February 15, 1994)

Professor Odhiambo further argues that poverty in science is more crucial than the immediate poverty of the material kind. This calls for a concerted effort by the governments to develop science and scientifically liberate citizenry. What comes out of science research should be harnessed. Efforts should be made to develop indigenous industries that can harness these

ideas from research. It is then that ideas from the National Students Congress on Science and Technology will be acknowledged and developed by industries.

SUMMARY OF THE NATIONAL STUDENTS CONGRESS ON SCIENCE AND TECHNOLOGY

Introduction

The National Students Congress on Science and Technology was held at the National Institute of Education, Singapore, from 19 to 23 July 1984. The Congress was attended by 1,000 students from 100 schools.

Objectives

1.1. Participation by all of the students

1.2. Participating Schools and Students

All of the schools in Singapore participated in the Congress and all of the students from the secondary level were encouraged to participate. The Congress was held at the National Institute of Education, Singapore, from 19 to 23 July 1984. The Congress was attended by 1,000 students from 100 schools. The Congress was held at the National Institute of Education, Singapore, from 19 to 23 July 1984. The Congress was attended by 1,000 students from 100 schools.

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CHAPTER V

SUMMARY, DISCUSSION AND RECOMMENDATIONS

5.0 Introduction

This chapter looks at the research questions formulated for this study with respect to the findings in Chapter Four. The findings are discussed, followed by recommendations.

Discussion

5.1. Participatory Impact of the Congress

5.1.1 Participating Schools and Students

Mixed schools are the least represented in biology exhibits and talks at the congress. This may imply that they are unable to compete favourably against the single sex schools. In the Kenyan system, most of the well-established schools are single-sex schools. These schools have a well-established tradition (Maundu, 1986) which facilitates their participation in the congress.

Girls from mixed schools are poorly represented among the presenters from mixed schools. Thus for the preparation of congress projects girls in mixed schools tend not to play an active role. Other researches have noted that in laboratory lessons girls tend to remain passive while boys perform most, if not all the work (Whyte, 1984). This passivity in laboratory lessons seems to be carried over to congress project work. As a result, girls lack the experience of working with a range of apparatus which preparation of congress projects would have helped them gain. This means that for mixed schools scientific activities are not experienced equally by both boys and girls. The range of school based science experiences for girls is less than that of boys in such areas as science observations, instrument skills and extracurricular activities (Whyte, 1984; Twoli, 1986).

That few A-level girls were among presenters of biology exhibits and talks at the congress is reflective of the smaller proportion of girls who were studying science at that level. There were fewer schools offering science for girls than those for boys at the ratio of 1:5 (Eshiwani, 1985). As a result few girls were being prepared to study science-oriented courses at university.

5.1.2 Why Some Students are not Involved in the Congress

The reasons identified were lack of time, lack of participatory opportunity and negative self-image.

The students' minds are so tuned to covering the biology syllabus, which is quite wide, that they consider involvement in the congress as diversionary. The congress is not part of the syllabus, as far as they are concerned. Yet the congress is actually meant to help pupils apply knowledge acquired in class to solve problems in their everyday life. This realisation is not felt by the students given the entrenchment of the traditional didactic teaching of science in Kenya. This makes students regard science as being relevant only within the confines of the school laboratory and having no relationship to everyday life. Yet the impact of science and technology on their (students') lives is spreading at an ever-increasing rate, prompting the need for many citizens to be exposed to some issues arising from the impact. Such issues include solution of biological problems we are facing today connected with food, feed, fibre, fuel, energy, pollution, availability of natural resources and environmental conservation. Students need to be involved in activities related to these issues through a variety of teaching activities of which congress project-work is one (Kille, 1987; Steward and Towse, 1987; Waddington, 1987; Rao, 1986).

Participatory opportunity is limited in schools through policies by the school heads that deny exposure to congress activities, failure to provide the visible encouragement, and their own preference of more attention securing activities such as drama, music and games. This is indicative of a school administration that does not realize the importance of the kind of activities that learners are engaged in, when preparing for the congress. They do not seem to appreciate how this kind of experiential

learning can be beneficially incorporated in science teaching and learning perhaps because they themselves were brought up on a solid diet of didactic teaching and were also trained to teach in the didactic mode (Jamieson, 1986).

Students' negative self-image manifesting itself in shyness, the belief that the congress is a preserve of those bright in science, the belief that the work is too difficult for them and the overdependence on the teachers for initiation of congress projects and their eventual development is a big hindrance to participation. The classical and authoritarian methods of teaching science which pervade the Kenyan school system cannot offer much help in correcting this negative predisposition. It is only practical, experiential teaching that could help change this (Baez, 1976.), thus, promoting the development of scientifically literate individuals.

5.1.3 Exposure to Congress Exhibits and Talks

Schools that participate in the congress enhance their students' exposure to congress ideas. This exposure is vital insofar as it enhances science - related experience that pupils are exposed to. Such experiences gained at school have been shown in developing countries to have a great influence on academic achievement (Heyneman, 1976). There is need of making the learning more deliberate as the pupils observe the congress exhibits and talks so that the students can notice the sharing of ideas involved which goes beyond the mere impression of the kind of presentations made. Students should go beyond just taking note of how impressive the exhibits and talks are and endeavour to find out the principles involved. On this level of interaction, the principles will be made clearer and the observer as well as the presenter of the exhibit or talk will benefit from the ideas shared.

5.1.4 Issues Affecting Participation

Factors affecting participation in the congress include students' and teachers' perception of the status of the congress vis-a-vis the curriculum, students' attitude, the role of the school administration, the role of the teacher, and the role of the parents.

The perception of most teachers and students concerning the status of the congress vis-a-vis the curriculum is that, it is too time consuming and hence diverts attention from their prime goal which is the coverage of the syllabus. Thus the congress is generally viewed as an unnecessary 'extra' to many teachers and students and hence not worthwhile. In the Kenyan system where a high premium is put on good examination grades, any activities that appear not to directly improve examination results are not given much support by schools.

The common expectation of educators is that because congress projects enhance learner participation, students should respond more positively. However, from observations made in this study, the response is negative. In fact, it is possible that because these activities do not readily fall within the mould of the traditional didactic teaching they may be viewed as mere 'role plays' and 'simulations'. These views are reinforced by the fact that such projects are not found in any textbook or syllabus and lack other aspects associated with traditional schooling. Pupils also find it difficult to cope with this experiential learning that congress projects necessitates, since they are more used to the didactic approach. In addition, the majority of teachers are not specifically trained in such a pedagogic mode and there are other impediments such as shortage of resources, and a constraint on time, that frustrate the successful implementation of this experiential learning (Kille, 1987; Jamieson, 1986).

Experiential learning does not conform to the traditional way in which time is organized in schools. One reason why schools have the traditional timetable slot of 35-40 minutes is that, it more or less, fits the attention span of pupils in didactic teaching situations. Experience-based learning requires more time than provided for in these slots. Thus a conflict emerges where teachers and students see the congress activities as going beyond the clearly demarcated timetable slots they are used to working with (Jamieson, 1986).

It is noteworthy that there are students who in spite of recognizing the time-constraint that this experiential learning imposes, are confident that it is possible to organise one's time to accommodate preparation of congress exhibits and talks. These are students who can be said to have

business-like behaviours which promote the predisposition that time is an investment and that the dividend is skill and knowledge (Haas, 1983).

So much stress is put on Kenyan examination passes that teachers are under considerable pressure to deliver requisite grades in the 'traditional' subjects. This forces the teachers to concentrate on the subject curriculum so as to attain the goal of examination passes (Jamieson, 1986). Thus anything that seems to divert attention from the course may not be welcome. Congress activities appear, from the teachers' and students' perception, bent on causing this unwelcome diversion.

The school administration in participating schools is deemed to provide the necessary moral and financial support. In the non-participating schools, this support is inconsistent or absent altogether. The administration will only give full support to congress activities depending on how it views the place of experiential learning in enhancing academic achievement. Consequently, where experiential learning is valued, the administration will promote participation. Participation will not be encouraged where the administration has no regard for experiential learning and in the long run the vicious cycle of didactic teaching will be maintained.

In many cases the administration is still grappling with the idea of allocating time for congress activities. It is difficult to have them accommodated within the present setting of traditional timetabling that is based on subjects. The problem of time causes conflict between the administrators, teachers and students on how best to accommodate congress work. It is such conflicts, if not properly resolved, that prompt poor attitudes towards the congress and consequently reduce the impact the congress could have had on achievement.

Teachers know they have a facilitating role to play in the congress but are held back by impediments such as the entrenched didactic mode of teaching, their kind of training, the pressure to deliver good examination results in the subject, and the problem of time allocation.

The teachers' perception of the organization and management of the congress as being inefficient must be addressed so as to enable the congress secure the intended impact. A forum should be provided for teachers and congress organisers to exchange ideas on their expectations of how the congress should be run.

Students recognise that the only way the rewards given at the congress would be commensurate with their efforts in preparing the exhibits and talks is through the adaptation and further improvement of their ideas at the industrial level. This reveals a serious omission in the science and technology congress. The exhibits produced in the congress are a good representation of the three basic types of skills that technology entails, namely: "designing", "making and producing" and "using". By the time the exhibit gets to the congress, it has passed through the first two skills of designing (i.e. creatively looking for a solution to a particular problem) and making (i.e. coming up with one or a few examples of something during or at the end of the design process). The skills of "producing" and "using" are the ones, that congress organizers have overlooked. "Producing" entails making large quantities of the first version of something while "using" entails critical evaluation to see if the product meets the stated requirements. Thus "producing" and "using" imply further development of congress projects after the school level and preferably at industrial level. If these exhibits are not further developed in this manner, then the congress organizers are guilty of perpetrating a lop-sided emphasis of technology as merely being creating of products. The "making" should not be separated from "designing" and "using" (Raaf, 1993).

Some parents are actually involved in the congress by providing the financial and moral support needed, and also in providing information needed in congress projects. Whereas this may not be very effective in enhancing their children's performance at the congress competition or even their scholastic achievement, it is still important to take note of this important dimension. It is a new dimension in the sense that research undertaken in developing countries has shown that academic achievement depends on factors other than socio-economic backgrounds such as parents' occupation and academic level (Heyneman, 1976; Twoli, 1986; Maundu, 1986). It is clear that there are classes of parents within Kenya, which is a developing country, who exert some influence on the academic

achievement of their children in ways similar to what has been noted in the developed world.

5.2 Impact of the Congress on the Development of Biology Education

5.2.1 Role of the Congress in Teaching and Learning Biology

Teachers and students realise the need for a biology curriculum that would be relevant to students' present and future lives. In Kenya there have been aspirations and attempts to develop a science curriculum that would show this relevance (Swift, 1987; Gachathi, 1976). However, findings from this study show that the congress, which is one of the ways through which this relevance would have been enhanced, is considered by teachers and students as an adjunct to the curriculum and therefore does not have the impact it otherwise would have had.

5.2.2 Relevance of Congress Projects to Biology Education

There is a conflict in teachers' and students' perception concerning the relevance of congress ideas to biology education with more students recognizing this relevance while many teachers (55%) rule it out. The teachers' apparent dismissal of the relevance aspect is based on a fallacious presumption that the congress projects are outside the syllabus. This shows how much the teachers are so tuned to the traditional subject curriculum that anything that is not presented therein is not considered relevant.

At the same time, many teachers (88%) consider the congress as enhancing achievement in biology. This contradiction shows that whereas these teachers may have ideas of what learner-centred learning does to enhance achievement, they have problems of reconciling the 'out-of-syllabus' projects and the beneficial learning that comes as a result of student involvement (Sund and Trowbridge, 1973).

5.2.3 Relationship Between the Congress and the Community

The projects made at the congress are in response to local needs. In this way students are able to use biological knowledge to solve problems. For instance, students are involved in developing better methods of fighting the mosquito menace in their community and developing economic ways of utilising plant and animal materials to meet the growing needs for food, fibre, fuel and nature conservation. This is a step in the right direction as it conforms with global changes in biology education towards a more relevant curriculum applying biology teaching to solving human problems (Rao, 1986; Atchia, 1986). Such application of biology education which is made possible through the congress helps to enhance the relevance of biology to the many students who will never have any more biology education after form four and who need an education that does not alienate them from the rural concerns, duties and skills (Swift, 1987; Twoli, 1986).

That there is a limitation of resources is a problem hampering development of congress projects. However, there are students who have come to learn that resources need not be a hinderance. They suggest that resources can be improvised. For this, a degree of imagination, creativity and courage is demanded and developed. Projects developed using local materials are more likely to respond to the needs of developing countries as they will be practical, relevant and appropriate. Projects developed in this manner, through overcoming hindrances, specifically help to encourage problem solving skills in students (Baez, 1976; Woolnough, 1986; Harlen, 1987)

5.2.4 Congress Benefits

Students should be encouraged to initiate their own projects as the findings of this research show that they work better on their own projects. This way the students are made to be managers of their own learning. They become investigative in their learning and thus acquire a greater understanding of biology, greater information retention, and better ability to think scientifically. In other words, the students are able to develop scientific attitudes such as curiosity (for finding facts and relationships), open mindedness, objectivity and the spirit of collaboration in search of truth

(Shulman and Tamir, 1973; Raghbir, 1979; Harlen, 1985).

That teachers are unaware of objectives of teaching biology is an unfortunate indictment of the people whose responsibility it is to guide students to achieve these same objectives. Their ignorance of these objectives and their replacing the syllabus with the textbook, makes their teaching lopsided in favour of content and at the expense of developing scientific process and manipulative skills and scientific attitudes (Shulman and Tamir, 1973; Raghbir, 1979; Beyer, 1985). It is the congress that provides an opportunity for addressing these ignored areas of learning. Yet due to teachers' ignorance of the objectives, they do not to a large extent, use this opportunity to enhance biology teaching and learning.

There is realization by teachers that congress projects could be handled multi-disciplinarily. This is because congress exhibits and talks are a product of science and technology, and technology is known to cut across all disciplines-humanities, science and the arts. Secondly, the development of congress exhibits and talks relies on the project method. This method shows how skills and techniques are brought together for reasons of solving practical problems in which the general direction is towards synthesis and practicality. Being products of science and technology, the proper integration into the educational programme of the congress exhibits and talks can infuse the educational process with a confident and competent approach to problem-solving which has met with success in the industrialized countries (Tipping, 1986; Dodd, 1986; Baez, 1976).

The congress has had very little impact on influencing the teaching methods used by teachers of biology. This is owing, to some extent, to the fact that many teachers have a prejudicial attitude that characterizes the congress as being irrelevant. With this attitude it is unlikely that, for the moment, the congress will influence teaching methods.

However, the congress influences the participants' depth of reading. They have to read widely and this enables them to acquire more knowledge in biology which they share with others. Acquisition of more knowledge implies deeper understanding of biology and the application of this

knowledge together with other organized knowledge to practical tasks enhances their technological capacity (Lewin, 1986; Naughton, 1986).

Participating in the congress develops the use of scientific method by the learners. This is because to make the exhibits it is imperative that scientific and process skills be used. These skills include formulating and stating of problems, controlling variables, handling equipment and other materials, designing experiments, making accurate observations, interpreting data, and making inferences (Beyer, 1985). These skills are important in the learning of biology.

As students prepare presentations they work within groups. This entails motivating and organising a group, first through designing and then through practical work, and the individual requires to find his place in such a group according to his ability, ambitions, personality and knowledge. The students come to realise that these biological and technological activities undertaken by them in the projects are the activities needed in all areas of inquiry. They are made to work alongside teachers and other students as co-workers (Raat, 1993; Page, 1986; Dodd, 1986).

The motivational orientation of students in biology is enhanced by the congress presentations they make. This is because projects are normally based on things that interest the students. As they prepare the projects, their curiosity is satisfied (Harlen, 1987).

The congress projects therefore, have the effect of infusing cognitive, affective and psychomotor development in the problem-solving aspect of work which students carry out as they prepare the biology exhibits and talks (Page, 1986).

5.3. The Disseminatory Impact of the Congress

The disseminatory impact of the congress on biology education has been very minimal. Since 1963 when the congress was first held till 1988, there were no attempts to document the projects presented at the congress. From 1989 onwards the organizers began making attempts in this

direction. From then on participants are required to present write-ups of their projects. Organizers are expected to edit these write-ups with a view to documenting the ideas. However, since 1989 when this idea of documentation was mooted, no document has been produced so far. The only avenues left for the students and members of the public to get a glimpse of what happens at the congress are attending the congress, media reports and visiting the Ministry of Education stand at the Agricultural Society of Kenya Nairobi International Show.

The novel ideas developed in the congress need to be harnessed, developed, documented and disseminated to as many people as possible. Only then will these technological ideas highlight their importance as activities perpetrated by people to fulfil people's needs. Then also, will the three basic sorts of skills involved in the projects, i.e. 'designing', 'making', and 'producing' and 'using' be seen in their right perspective. Thus, the biological and technological ideas advanced will have an influence on society and society will in turn respond to these ideas if properly disseminated. The response of society to the ideas has the effect of preventing biology and technology from becoming an immutable system. The response will prompt a move towards improvement, growth and development of biology and technology. The novel ideas will lead to improving the lot of the poor as they provide solutions to their immediate problems (Raaf, 1993; Baez, 1976).

5.4. Congress Links with Industry

There are very many new biological and technological ideas on display at the congress which industry could harness to improve their products. However, in Kenya, industry remains somewhat indifferent to these new ideas. The Bangalore Conference (1985) on Education, Industry and Technology, noted that industry was part of the community as it includes concern for people, raw materials and the final product, and involves solution of human problems. Students should be made aware of this and the potential symbiotic relationship between industry and the classroom. The gap between education and industry needs bridging (Holbrook, 1987; Chambers, 1987).

The problem of the gap between education and industry in Kenya is compounded by the fact that there are no truly indigenous Kenyan industries. Most industries are owned by foreign Multi-National Corporations (MNCs). These MNCs are encouraged to invest in the country, and are provided with an exclusivity which constrains the surrounding competitive environment. In addition, these MNCs are least concerned with technological transfer from the mother country to the host developing countries (Kerre, 1990). Consequently, such industries may never encourage the education-industry link, least of all the Science and Technology Congress activities as they may not feel obliged to help develop the education system of the host country. Perhaps, indigenous industries can do much to stimulate the development of such ideas demonstrated in the congress and harness them for further use. Only then will the biological and technological capabilities that these exhibits and talks seek to promote be realised.

Recommendations

In view of the findings discussed in the foregoing section, the following recommendations can be made:-

1. There is still a need to work towards developing a biology curriculum that is more relevant to the needs and aspirations of the country. The didactic mode of teaching that pervades the education system stifles the development of biology congress projects and the impact these projects could have on development of biology education. A biology curriculum that will promote experiential learning will respond better to the needs of the country.
2. The training of biology teachers should be of the type that prepares them for the new role of experiential teaching as opposed to the traditional didactic teaching. Thus, better methods of training these teachers should be evolved.
3. The present education system puts a lot of emphasis on examinations. There needs to be a change which will enable learners to develop other areas that may not be examinable but which help them to apply biological knowledge and principles acquired in school to their surroundings for present and future utility.
4. The continued use of the didactic approach to teaching and learning of biology should be de-emphasized as it encourages much student dependency on their teachers. Students should be made more responsible for their own learning through activities such as project work which will develop their decision-making and problem solving capacities.
5. There should be a forum for teachers and organizers of the congress to share their experiences more frequently to facilitate improved understanding of the role of the congress in science education and nation building.

6. There is need for frequent inservicing of biology teachers to keep them abreast of the objectives as well as the changing trends in biology and technology education.
7. Much emphasis of the congress projects should be on the use of locally available materials which can enhance the relevance of the projects to solving local problems.
8. The students' projects should be developed further for use by many who will benefit from the innovative ideas. In this regard the issue of patency should be addressed squarely.
9. Documentation and dissemination of congress ideas and information needs to be intensified through regular newsletters, magazines, video tapes, etc.
10. There is need to stimulate the development of indigenous industries which will in turn help to promote the development of biology and technology education as well as the establishment of strong school-industry links and collaboration.

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QUESTION: THE STATE OF TEXAS HAS A STATE BOARD OF EDUCATION WHICH HAS THE AUTHORITY TO ADOPT CURRICULUM STANDARDS FOR THE STATE OF TEXAS.

ANSWER: _____

QUESTION: THE STATE OF TEXAS HAS A STATE BOARD OF EDUCATION WHICH HAS THE AUTHORITY TO ADOPT CURRICULUM STANDARDS FOR THE STATE OF TEXAS.

ANSWER: _____

QUESTION: THE STATE OF TEXAS HAS A STATE BOARD OF EDUCATION WHICH HAS THE AUTHORITY TO ADOPT CURRICULUM STANDARDS FOR THE STATE OF TEXAS.

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ANSWER: _____

QUESTION: THE STATE OF TEXAS HAS A STATE BOARD OF EDUCATION WHICH HAS THE AUTHORITY TO ADOPT CURRICULUM STANDARDS FOR THE STATE OF TEXAS.

ANSWER: _____

APPENDIX A

QUESTIONNAIRE FOR BIOLOGY TEACHERS

School _____

Classes Taught _____

Sex _____

I am interested in understanding the impact of the 'Kenya' National Students' Congress on Science and Technology' on the teaching and learning of biology. Below are statements related to this. Against each statement are letters S.A. (for Strongly Agree), A (for Agree), N.S. (for Not Sure), D (for Disagree), and SD (for strongly Disagree). Circle the right letter depending on what you feel about each statement. Give a reason for your choice.

Please answer all Questions.

1. The science congress has an impact on biology teaching strategies used in Kenya.

SA A NS D SD

Reason _____

2. The exhibits and talks presented are related to the objectives defined in our current secondary school biology syllabus.

SA A NS D SD

Reason _____

3. The exhibits and talks are an extra-curriculum activity not related to the Kenya Examinations Council examination questions set in the subject.

SA A NS D SD

Reason _____

4. The school time table leaves enough time for the preparation of the National congress exhibits and talks.

SA A NS D SD

Reason _____

5. Involvement in the preparation of exhibits and talks contributes positively to the improvement of the students' achievement in biology.

SA A NS D SD

Reason _____

6. Lack of resources (books, equipment etc.) hinders the process of coming up with quality exhibits and talks.

SA A NS D SD

Reason _____

7. All subjects in school have a contribution to make in the development of exhibits and talks at the National Science Congress.

SA A NS D SD

Reason _____

8. The teaching of biology should concentrate solely on aiding students to pass their terminal examinations.

SA A NS D SD

Reason _____

9. Through involvement in developing exhibits and/or talks the student is better prepared to cope with problems that arise in everyday life.

SA A NS D SD

Reason _____

10. Understanding projects helps to improve the students' manipulation of apparatus in search of solutions to problems.

SA A NS D SD

Reason _____

-
16. The organisation and management of the congress tends to discourage participation.

SA A NS D SD

Reason _____

17. Projects and talks presented at the congress help to show that what is taught in the classroom is related to day to day activities that affect our lives.

SA A NS D SD

Reason _____

18. Projects and talks developed improve our understanding of how biological principles work.

SA A NS D SD

Reason _____

19. Project work gives students a chance to work like scientists.

SA A NS D SD

Reason _____

20. Project work gives students a chance to interact and work together.

SA A NS D SD

Reason _____

21. Students should be encouraged to develop projects at any time without necessarily waiting for the congress season.

SA A NS D SD

Reason _____

22. The assessment of students' projects and talks is objective.

SA A NS D SD

Reason _____

23. Industry can make use of the projects presented at the congress.

SA A NS D SD

Reason _____

24. Learning of biology is related to processes undertaken in industry.

SA A NS D SD

Reason _____

APPENDIX B

QUESTIONNAIRE FOR STUDENTS INVOLVED IN THE CONGRESS

School _____

Class _____

Sex _____

I am interested in understanding the impact that the 'Kenya National Students' Congress on Science and Technology' has had on the teaching and learning of biology. Below are statements related to this. Against each statement are letters SA (for Strongly Agree), A (for Agree), NS (for Not Sure), D (for Disagree), and SD (for Strongly Disagree). Circle the right letter depending on what you feel about each statement. Give a reason for your choice. Please answer all questions.

1. In the choice of the topic for talks/exhibits, I was inspired by problems around where I live.

SA A NS D SD

Reason _____

2. The exhibits and talks are an extra-curriculum activity not related to the examination questions set in the subject.

SA A NS D SD

Reason _____

3. The school timetable gives time for the preparation of exhibits and talks.

SA A NS D SD

Reason _____

4. Involvement in the preparation of exhibits and talks contributes positively to bettering performance in biology.

SA A NS D SD

Reason _____

5. Lack of resources (books, equipment etc.) hinders the process of coming up with quality exhibits and talks.

SA A NS D SD

Reason _____

6. The teaching of biology should mainly concentrate on helping students to pass their Form Four examination.

SA A NS D SD

Reason _____

7. The exhibits and talks presented at the congress are initiated by the teachers and not students.

SA A NS D SD

Reason _____

8. Projects and talks presented at the congress help to show that what is taught in the classroom is related to day to day activities that affect our lives.

SA A NS D SD

Reason _____

9. Projects and talks developed improve our understanding of how biology principles work.

SA A NS D SD

Reason _____

10. Project work makes the learning of biology more interesting.

SA A NS D SD

Reason _____

11. The exhibits and talks encourage one to read beyond what the books say.

SA A NS D SD

Reason _____

12. Projects made are relevant to life situations, particularly at community level

SA A NS D SD

Reason _____

13. The organisers of the national congress do not give good rewards at the competition.

SA A NS D SD

Reason _____

14. The national congress only favours big schools.

SA A NS D SD

Reason _____

15. Opportunities for employment in industry could serve as an incentive for participation in the congress.

SA A NS D SD

Reason _____

APPENDIX C

QUESTIONNAIRE FOR STUDENTS NOT INVOLVED IN THE CONGRESS

School _____

Class _____

Sex _____

I am interested in understanding the impact that the 'Kenya National Students Congress on Science and Technology' has had on the teaching and learning of biology. Below are statements related to this. Against each statement are letters SA (for Strongly Agree), A (for Agree), NS (for not Sure) D (for Disagree), and SD (for Strongly Disagree). Circle the right letter depending on what you feel about each statement. Give a reason for you choice. Please answer all questions.

1. State the reasons for your non-involvement in the congress.

2. (a) Have you ever attended any science congress?

Yes _____ No. _____

(Tick as appropriate).

(b) If Yes, state some things that impressed you at the congress.

3. The projects developed for the congress are too time-consuming and hence cannot allow one to cover his/her work in other subjects.

SA A NS D SD

Reason _____

4. The exhibits and talks prepared are extra-curricular activities not related to the examination questions set in biology.

SA A NS D SD

Reason _____

5. Involvement in the preparation of exhibits and talks contribute positively to bettering performance in biology.

SA A NS D SD

Reason _____

6. The teaching of biology should mainly concentrate on helping students to pass their Form four examination.

SA A NS D SD

Reason _____

7. The exhibits and talks presented at the congress are initiated by the teachers and not the students.

SA A NS D SD

Reason _____

Projects presented are relevant to life situations, particularly at community level.

SA

A

NS

D

SD

Reason _____

APPENDIX D
INTERVIEW GUIDE FOR POLICY MAKERS

1. What category of schools are involved in the congress and from which regions are they?
2. What is the proportion of each gender among the participants?
3. What changes have taken place from 1985 - 1992 in terms of the number of schools involved, gender of participants, and kind of projects?
4. In your opinion what are the reasons for participation of some schools and non-participation of others?
5. How are the participants rewarded? Do the rewards stimulate greater participation?
6. What are the organisational strategies for the documentation and dissemination of new ideas and talents of the congress?
7. What are the follow-up procedures adopted by the organising committee?
8. Are the exhibits and talks further developed and used?
9. Are the exhibits taken to the Agricultural Society of Kenya Show? What is the response from the public?
10. Do the talks and exhibits reflect new trends in teaching and learning of biology?
11. Do the talks and exhibits promote new technology in biology?
12. In what ways has the congress contributed to the teaching and learning biology?
13. What are the links between the congress and industry?
14. How can these links be exploited and strengthened?
15. What support is given to the congress by parents and government?
16. Do the exhibits presented relate to the community needs and problems?
17. Is there sharing of ideas between the congress and jua kali artisans?

APPENDIX E**DOCUMENT ANALYSIS GUIDE**

1. What types of schools participated in the National Congress between 1985 and 1992?
2. What is the gender distribution of participants between 1985 and 1992?
3. What topics were presented from 1985 to 1992?
4. Who were the sponsors of the congress from 1985 to 1992?
5. What contribution have the sponsors made to the congress?

APPENDIX F
OBSERVATION GUIDE FOR CONGRESS ACTIVITIES

1. What is the topic presented?
2. How is the data communicated to the audience?
3. What kind of interaction is there between the presenter and the judges, and the presenter and the audience?

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