UTILIZATION OF INSTRUCTIONAL RESOURCES

A Review of Published and Unpublished Research from Eastern, Central and Southern Africa

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This paper reviews results of 30 studies * on utilization of instructional resources. It contains a description of the studies and reviews the results in six major areas.

1. Instructional materials
2. Textbooks
3. Mass Media and Distance Learning
4. Laboratories and Science Equipment
5. School Buildings and Facilities
6. Exercise Books and Pencils

The general conclusion of this review is that although the provision of instructional aids, especially textbooks, seems to be the most cost-effective way of

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* Please note that all references in this Review can be located in Eshiwani G.S. Improving

increasing the quality of education in Africa, there is a serious scarcity of instructional materials, textbooks, laboratories and science equipment. There is a need to develop local capacity to design, produce and distribute these materials. Above all, there is an urgent need to train teachers on effective utilization of these instructional materials including efficient use of classroom space in the school and technologies such as interaction radio broadcasts.

Of the studies reviewed there seemed to be a major gap on the question: What kinds of materials have what kinds of costs and learning outcomes? This is an extremely important issue to which research should respond given the limited financial resources available to most countries in Africa. Two other important issues that seem not to have received much research attention are the use of instructional space and the availability of exercise books and pencils to pupils and how these affect learning outcomes.

A REVIEW OF PUBLISHED AND UNPUBLISHED RESEARCH IN EASTERN AND CENTRAL AFRICA ON UTILIZATION OF INSTRUCTIONAL RESOURCES

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Introduction

Evidence from studies by the World Bank and other international organizations on the quality of learning achieved in the developing countries points to the great importance of the following school inputs: teachers (class size, teacher training and morale); instructional materials (textbooks and other reading materials; writing implements (radio and other instructional media); school buildings and facilities; nutrition and health of children; language of instruction; and examinations.

This review is concerned with one major school input, namely utilization instructional resources. The extent to which instructional resources are utilized and how the utilization affects learning efficiency will be discussed.

The major objectives of this review are to: (1) describe patterns of utilization of instructional materials/ by teachers and schools in Eastern, Central and Southern Africa, (2) identify the relationships between utilization and costs of instructional materials and student learning, and (3) indicate system policies that have been effective in increasing the utilization of materials that result in greater student learning, issues of the teacher's understanding of the instructional materials. In addition, the review should attend to teacher participation in determining such materials, and teacher education.

Definitions and Conceptualization of Instructional Materials and its Utilization

The range for what is an instructional material ranges within a classroom from a piece of chalk to the more sophisticated electronic equipment. Moreover, instructional materials are viewed differently by teachers and students, parents, and government officials. For example, instructional materials at a distal level may be only represented by the availability and presence of textbooks in classrooms; whereas, at the proximal level,

attainment of the grade level and skills required by the materials, may be more critical for the teacher and student. For parents, it may be that having "portable" instructional materials, that are visible, durable, and easy to carry may be a significant determinant of the utilization of materials. In this review our attention was therefore directed to what makes the utilization of instructional materials significant and cost effective at the proximal and consequently, distal levels.

Psacharopolous (1985) has pointed out that it is not enough simply to provide instructional materials such as textbooks. Some efforts must be made to ensure that they are adequately used. In this connection, we have included the following issues in our discussion:

a. Research about the nature and purpose of instructional materials and teachers' decision-making processes in their selection, adoption, adaptation and utilization.

b. Research on the presence and utilization of instructional materials in relation to teaching-learning and efforts to use classroom research to improve teaching practice.

c. Research on the relevance of instructional materials to actual student learning. For example, do basal readers which are used throughout the Third World contribute to actual student achievement measures, irrespective of

their content relevance? Put another way, "what makes instructional materials relevant?"

d. Research on teachers' preparation for utilization of instructional materials. Are instructional materials viewed as ends in themselves or are they a means to attain student achievement outcomes? What is the relationship of homework to instructional materials, and to outcomes? Issues of pre-and in-service education are worth exploring in this regard. It is not clear whether teachers assume that instructional materials are in fact, curriculum. Often, curricular guidelines become interpreted and imitated by teachers as instructional methods divorced from curriculum goals (pedagogy).

Fuller (1985) has identified three areas in which little research seems to have been carried out in connection with the utilization of instructional materials. These areas are:

1) the influence of teaching practice to instructional materials,
2) the use of instructional materials in relation to classroom organization, and
3) the relationships of management practices to utilization of materials.

Considering the objectives of this review, research information on the utilization of instructional materials from the World Bank and other international organizations such as the International Development Research Centre, and observations by Psacharopolous and Fuller, the main questions that this review attempted to answer are:

1. What are the resource allocations of materials in terms of supply, demand and distribution? In what ways does the determination and utilization of instructional materials conform to the specifications required by the Ministry of Education?
2. What kinds of materials have what kinds of costs and learning outcomes?
3. How are materials selected and distributed to different contexts? What supervision of their use is evident?
4. What linkages exist between instructional materials and other learning technologies available to teachers? What kind and how much educational do teachers receive in development and use of instructional materials? Frequency of use?
5. What are the teacher's expectations for student achievement and how are these related to textbook usage, appropriateness and relevance of instructional materials? What is the relationship of fidelity of

utilization to the effectiveness of materials?

6. What is the teacher quality in determination of materials? Teacher expectations of student learning along gender lines, differentiated teaching with materials? Actual gender representations in materials? What, if any are the developmental characteristics of the instructional materials?

7. What are the relationships between use of instructional materials and learning outcomes?

8. In what ways do central system policies affect the use of instructional materials in ways that contribute to increased learning?

Most African countries experience a shortage of qualified teachers at all levels. Classroom instruction is often given by unqualified or relatively poorly trained teachers. Given this situation, it is evident that provision of good teaching resources is likely to improve the quality of learning. This is likely to be the case because provision of such instructional materials will help promote the proper sequencing of learning activities in the classroom and suppliment teachers' limited knowledge.

Instructional Materials

Lending institutions in the education sector in Africa (the World Bank, the African Development Bank, etc..) seem to be convinced that the provision of instructional materials, especially textbooks, is perhaps the most cost effective way of increasing the quality of education in Africa. These institutions are concerned with the scarcity of learning materials in the classrooms in Africa. For example, in a recent major policy paper, the African Development Bank observed:

> "The supply of appropriate teaching materials is particularly inadequate in large part of Africa. While this is to some extent a question of finance, the issue of producing and distributing adequate teaching materials for African schools goes much beyond the question of funds. As there is an urgent need not just for any teaching materials and text-books, but for materials that are more closely in tune with the realities and needs of African societies, a major field of lending activity opens up here. Bank Group Loans will support, not just some of the technical assistance needed in modifying and adapting existing textbooks and materials and preparing new materials, but also the production and distribution of these materials in Africa. Educational Resource Centres in areas where there is a particularly serious shortage of instructional materials could be another example of this general thrust. In this area of quality and internal efficiency, as the majority of the non-salary inputs have a direct effect on the qualitative aspects of educatio, the Bank Group will give priority to assisting regional member countries identify and maintain minimum standards for non-salary inputs."

Similarly the World Bank has stated that:

> "At present, developing countries devote a very small proportion of school expenditure to teaching resources, including books, maps, or visual aids. Industrial countries allocate 14 percent of primary school recurrent costs to classroom resources (books, teaching aids, furniture, and so on) and 86 percent to salaries, whereas the average in Asia is 9 and 91 percent, and in Africa 4 and 96 percent. Thus even a small reallocation of resources could increase efficiency; in fact, it has been suggested that a minimum of 10 percent of public recurrent expenditures should be devoted to teaching tools (Heyneman, Jamison, and Montenegro 1984). World Bank lending today reflects this change in emphasis. Whereas not one of the thirty-one education projects appraised by the Bank between 1963 and 1969 contained specific support for classroom materials, the provision of classroom materials has been a principal component in several projects since 1976."

Among the studies reviewed from Eastern, Central and Southern Africa ten dealt with instructional materials. Evidence in these studies indicated that there is a scarcity of teaching materials in most schools due to fiscal stringency experienced by most countries in the region. The scarcity seems to go beyond the availability of funds. Most countries in the region have yet to develop a national capacity for the development of low-cost

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1. Education Sector Policy Paper (pp. 15-16)
   The African Development Bank
   Abidjan, January 1986.

2. Psacharopolous G. Education for Development pp. 224.

teaching materials that are pedagogically sound. Some of the reasons that have led to inneficiency in the production of teaching materials in most countries in Africa are: lack of expertise in the design, preparation and evaluation of materials; inadequate training of teachers in the use of these materials; lack of production capability, and poor organization of distribution.

Eshiwani (1983) in his study "Crowded Classrooms in Kenya" investigated the extent to which instructional materials are available to the classroom teacher and how he utilizes the materials. He found that out of the classes that were surveyed 96% had one or more chalkboards; 75% of the blackboards were for writing on with chalk. Surprisingly less than 50% (45.8%) of the teachers possessed white chalk and only 37% had coloured chalk. A few classrooms (37%) had blackboards for writing on with special markers. On average, teachers write on the blackboard between 5 and 10 times a day. This makes the blackboard perhaps the most used visual aid in teaching in the primary school in Kenya. Pre-service and in-service training of teachers should take cognizant of this to ensure that teachers are well prepared to use this seemingly important aid - the chalkboard.

The absence of chalk in the school was great limitation to a number of teachers. Administrators should be aware of the importance of the chalkboard as an instructional tool and provide both the blackboard and the chalk to the teacher.

Next to the blackboard, textbooks and exercise books are the most important teaching/learning aids. In this study it was found that in general teachers had textbooks for the subjects they were teaching. These textbooks belonged to the school. Very few teachers possessed personal copies of the textbooks. The teachers said that they use the textbooks several times a week to prepare their lessons.

The pupils' textbooks were provided by the school. Only a few pupils had bought copies of their own. In most subjects, there was one textbook shared by three pupils. In some schools, one textbook was shared between five to ten children. In some cases the only person with a textbook was the teacher.

There were no slates in all the classes that were surveyed. Exercise books were used in all classes including standard one. In the lower classes each pupil

had one or two exercise books while in the upper classes each pupil had more than five different exercise books. The exercise books for the upper primary school were for the following subjects: english, spelling, religious education, science, social studies and mathematics. Because pupils had to buy the exercise books at their own expenses from local shops, it was found that an average of 30% of the pupils did not have the required number of exercise books, nor did they have writing materials such as pencils and pens.

It is interesting that in a situation where paper is very expensive (making the cost of exercise books high), teachers do not encourage the use of slates especially in the lower primary school. In the classrooms where exercise books existed, there was a lot of wastage. There was no scrap paper on which children could do rough work - especially in mathematics.

Practical back-up materials for learning mathematics in the classroom studied included counting materials (small pebbles, small dried fruits, bottle tops and small wooden blocks, coloured sticks) and a few wall charts. The counting materials were used mainly in the lower primary school. Several teachers that were

interviewed were not aware of other basic teaching aids nor did they care much about local and international measuring instruments for teaching weights, lengths, volumes and capacities.

Apart from a few schools which had spirit duplicators, most schools in the study (70%) did not have a duplicating machine. This means that teachers cannot duplicate teaching and learning materials for the pupils. A point in case is when the teacher wishes to give written tests or assignment to the pupils. The teacher has to write the assignment on the blackboard and then the pupils copy it out in their exercise books. This wastes a lot of valuable time both for the teacher and the pupils.

The Kenya Institute of Education through its Education Media Service has daily broadcasts to schools. For this reason, the study revealed that although schools did not have such sophisticated teaching aids as the slide projector, the overhead projector, television set, computer terminal and tape recorders, they had a radio. The extent to which these radios were used for teaching/ learning purposes was doubtful. The radio was found kept either in the headmaster's office or by a teacher. Some

teachers in the schools surveyed were not even aware that their schools had radios.

Lebusa (1981) in her study entitled "A critical survey of teaching strategies involving instructional materials in the teaching of Sesotho reading in Standards One to Three", observes that

> "Lesotho Education system seems to have the problem of lack of instructional materials, thus teachers working under such circumstances face a lot of difficulties."

The objective of Lebusa's study was to survey and analyse strategies, methods and instructional materials used in the teaching of mother-tongue (Sesotho) reading in Lesotho standard 1 - 3 with a view to identifying their strengths and weaknesses.

Lesotho has seven-year primary cycle which terminate with a national examination. One of the major goals of Lesotho educational system is that primary school children should acquire the basic language skills in Sesotho to enable them to communicate freely in the language. To attain such a goal, Sesotho language must be taught properly in primary schools. To achieve this

goal there must be a wide range of instructional material and teachers must be properly trained in how to use the materials. The Lesotho Government has not been in position to supply these materials adequately to schools, therefore, teachers are left with problems of not only identifying relevant instructional materials, but also how to make use of them accordingly to achieve the desired instructional objectives.

Lebusa recommends that:

- All primary schools should pay special attention to the development and use of low-cost instructional materials.
- The teacher must scheme, plan and prepare carefully on the methods used.
- Teachers should involve the students more in preparation and use of instructional materials.

A second study that looked at instructional materials in language was by Kiganda (1980). The main objective of Kiganda's study was to produce and evaluate a sample instructional materials for "the new English

syllabus" for secondary schools. The instructional materials proposed new approaches to the teaching of English as an integrated subject and their suitability in divergent environments e.g. well equipped classrooms and poorly equipped classrooms.

Kiganda found that:

- The students' response to the material was generally good.
- The majority of students identified with characters, activities and environmental setting of the feature story in the material.
- The instructional objectives were largely, but not fully achieved and the teachers notes proved fairly useful, though not absolutely essential to the teachers.

It can be concluded from Kiganda's study that with training it is possible for teachers tc produce their own instructional materials that are relevant to their teaching needs.

Nkamba (1984) studied "The Development of music curriculum and instructional materials for primary schools

in Zambia." He was very critical of music curriculum in Zambia and explained the shortcomings of this curriculum on lack of relevant instructional materials. In his recommendations he observed that in order for the music curriculum in Zambia to improve, the following steps must be taken:

- There should be a systematic approach to the development of instructional materials.
- There must be a vigorous campaign in making Zambian traditional music instruments.
- There should be intensive research into Zambian music instruments.
- The training of music teachers should be improved with a view of helping them to utilize local music instruments.
- The local community and music experts should be utilized in teaching teachers and pupils how to use local music instruments effectively.

Nkamba's study calls for relevant instructional materials in classrooms in Africa. Too often one finds schools struggling to purchase expensive materials such as the Cuissainnair rods or imported abacus for use in teaching mathematics when there are many relevant materials

in their environment that could be used equally effectively. Part of the reason for this is the teachers' inability to select the appropriate materials from the schools' environment.

Studies reviewed revealed that there is a major gap in research on the effect of instructional materials on such subjects as mathematics, science and social studies. Performance in mathematics has continued to be disappointingly poor in the African region. Although this may be attributed to poor quality of teachers, the major explanation seems to lie with the non-availability of appropriate instructional aids.

Mukwa (1979) investigated the availability of audio-visual media to schools, the role played by available media in up-grading classroom learning and teaching, and administrator's perception of the value of audio-visual media. The main purpose of the study was to identify the instructional media being used in the secondary schools and to determine in which of the subjects: languages, mathematics, social studies and science, are teachers motivated to perceive instructional media materials as valuable in the teaching learning process.

Mukwa's study revealed that the instructional media available to secondary schools in Kenya were: printed media, posters and flat pictures, tape recordings and radio programs, TV programs and techniques such as drama and folk media; field trips, educational games and simulations. Of media available to schools 45% had motivational and learner participation learning techniques designed in the media. Apart from TV programs, multimedia, film trips and transparencies, most media available to schools were perceived effective in upgrading teaching and learning. School administrators are more motivated in perceiving the value of media than classroom teachers. Business course teachers were more motivated in perceiving the value of media. They were followed by science, social studies, mathematics and language teachers. There was no difference in perception of media between rural and urban teachers.

Lack of local media, need of training in preparing media material, equipment operation and maintenance, are some of the common constraints to the effective use of instructional media. Majority of teachers indicated that Instructional Development Inservice Program, and communication between media material producers and teachers should be improved.

A provisional systematic approach to media use was proposed featuring around some organisational and administrative vantage levels; thought needed assessment, explicit statements of objectives, identification and examination of available alternatives, resource allocation and utilization logistic consideration and feedback, research and evaluation.

Mukwa's study points to one observation that the availability of instructional media can be useful in teaching and learning processes in Kenya schools so long as educational planners and decision makers embrace it as a system and integrate a range of human and non-human resources into the total educational process.

Finally, it is pertinent to emphasize that in addition to their development and production, teaching materials need to be stored adequately, and distributed to schools in a timely manner, and teachers need to be trained in their use. All this requires organization and planning and, above all, funds for transport. This implies that Governments in the Africa region will have to put more efforts and resources into the design, production and distribution of learning-instructional materials including equipment and printed matter.

Textbooks

The availability of textbooks has been found to be the most consistently positive determinant of academic achievement. For example results from the Phillipines indicate that after the first year, learning in the first grade increased 12 per cent on tests in mathematics, science and language after sufficient investiments were made to alter the ratio of pupils to book from 10:1 to 2:1. In a recent study on the quality of private secondary schools in Kenya, Eshiwani (1986) found that:

- There is a clear relationship between the availability of textbooks and achievement in mathematics.
- Textbooks influenced the instructional styles used by teachers of mathematics.

In addition to studying the effect of availability of textbooks on achievement, it is important to know the extent to which the textbooks being used in schools in Africa are relevant to the learning needs of the pupils. In this connection three studies were identified for review:

Durojaiye (1971) studied tha language of textbook with respect to the demands made on pupils in their first year of secondary school in the following subjects: Chemistry, Physics, Biology, Mathematics, History and English. Four aspects of language were analysed: type of vocabulary, length of sentences, degree of surbordination, and verb forms.

The language of textbooks affects pupils' understanding; teachers tend to despair at the apparent lack of understanding of concepts of their subjects shown by their pupils in their written work and in their use of textbooks. It is also common to find pupils memorising a whole page of a textbook and reproducing it perfectly in the examination. In this connection, Durojaiye's study is significant. She found that:

- The vocabulary level and sentence complexity of the various textbooks vary considerably in level of language. Taking the language level of the English course book as the standard, it was found that three of the textbooks in other subjects far exceed the English course in rate of introduction of unknown vocabulary.

- The Mathematics texts were written by people who know the language problems of secondary one (SI) pupils, while the authors of Chemistry, Physics and Biology Texts were mainly foreigners who are native speakers of English.
- Although great care had been exercised over the language structure used in Mathematics text, Mathematics as a subject was characterised by specialised vocabulary which present problems to the pupils and teachers.

Durajaiye concludes from her findings that:

"The types of sentences used in a text may cause difficulties to pupils' understanding of a subject. If textbooks can use simple present verb forms the language demands on pupils will be minimized".

She also observes that every subject has a language register. In selecting textbooks for use in teaching, this fact should be taken into account. It is reasonable to select textbooks which introduce this special vocabulary in reasonable proportion and each subject

teacher must make a point of helping pupils to cope with the items. This can be done through demonstration (using visual aids), models and explanation in conveying language.

English teachers should ensure that the course is rearranged so that items such as passive and past verb forms, which are in demand in other subjects are taught very easily. Pupils should be given intensive practice in these aspects of English early in the course.

Dosi (1980) evaluated the Primary English Book I and II for Tanzanian schools to find out the extent to which the books were relevant. He found that most pupils and teachers had a positive attitude toward both textbooks and they were motivated enough to use the books; the content in the textbooks was sequenced in relation to the learners' abilities; and the textbooks seemed to appeal to the interests of the learners.

In addition, Dosi found that there was an average of one book for every three pupils in Standard III and one book for every two pupils in Standard IV; pupils used the book at school only.

Following these findings Dosi recommended that:

- The size of the textbook should be reduced preferably the size of an exercise book.
- Hard covers should be used to make them last longer.
- Colours should be used wherever they have been stated.
- Textbooks should be more available than they are at present.
- Teachers should attend more seminars and short courses on the use of the textbooks.
- Teachers' handbook or a guide should accompany the PET Books.

These recommendations have far-reaching policy implications.

Ochola (1983) studied the relevance of 'suggested' textbooks for the teaching of the new Chemistry syllabus in Kenya Secondary Schools. He also analysed the role of the texts in promoting practical skills and encouraging the process of scientific inquiry. Ochola found that:

- The textbooks that he analysed were not

relevant in the teaching of the new Chemistry syllabus. Although the new course was laboratory orientated, the textbooks emphasized theory.

- Teachers were not given opportunity to select textbooks. The decision concerning which books schools shall buy is highly centralized.

Among the many recommendations made by Ochola the following seem important:

- There is need to decentralize the procedure for recommending books.
- The responsibility of buying texts should be transferred to parents.
- Teachers need to train their students to acquire necessary skills in notes making.
- There is need to compile laboratory materials that allow far more inductive reasoning and generalization by students.

The recommendation regarding the responsibility of purchasing textbooks being passed to parents is an interesting one and requires a further comment. Next to providing trained teachers textbooks remain the most costly item required for minimal standard of education. It is not surprising, therefore, that the provision of textbooks is

inadequate in many schools in Africa.

In order to produce textbooks that are relevant and in the required quantities, it would seem that Governments in Africa should aim to develop national skills to adapt and edit and, in some countries, write and publish such materials. The printing of materials in large quantities, however, at this time can generally be done more economically abroad owing to the need for costly-specialized machinery. Small countries with limited educational markets are particularly difficult to serve economically. Cooperation with neighboring countries would offer economies of scale, especially for the development of materials in local languages common to a group of countries.

Mass Media and Distance Learning

Apart from tangible instructional materials discussed in the above paragraphs, distance education through radio broadcasts has proven in some countries (e.g., Kenya, Malawi, Tanzania) to be effective. For primary education, the use of radio broadcasts would usually represent an add-on cost, but one that can be expected, based on a recent experiment in Kenya to yield significant learning dividends.

Mass media and distance learning has potential for fulfilling three objects. First educational broadcasting improves educational efficiency by improving the quality of instruction in traditional subjects, by providing instruction in subjects for which qualified teachers are not available, by supplementing curriculum reform, and by reducing repetition among slow learners. The teaching of mathematics by radio in Nicaragua, for example, contributed to a reduction in the rate of repetition. Second, mass media, usually in combination with printed materials, can provide distance learning to persons unable to attend classes. Such projects are under way in the Dominican Republic, Kenya, Republic of Korea, Mauritius, and numerous other countries. Third, the use of mass media

can reduce education costs, if the number of users reaches a given minimum level. If radio projects are properly designed and supported, they can have a high potential for improving efficiency.

Nine studies by Eshiwani (1983), Walugere (1980), Mainje (1980), Obiero (1980), Osodo (1985), Chimerah (1982), Murphy (1980) and East African Publishing House (1970) on mass media and distance learning were reviewed. Out of the nine studies five were concerned with the effectiveness of instructional radio broadcasts. Eshiwani (1983) evaluated the effectiveness of the Radio Language Arts Project programmes in Kenya. The RLAP programmes consisted of 195 radio lessons covering an entire curriculum in English for Standards One, Two and Three. Results of the evaluation showed clearly that in general the performance of pupils who had participated in the RLAP was above average for Standards one to three. The Radio Language Classes performed substantially and statistically better than control school. This was true for reading and oral communication. RLAP seems to have been effective in the area of reading and speaking English in Standards One to Three. The attitudes of teachers and Headmasters towards RLAP was positive.

Based on the above results, Eshiwani recommended

that:

- The RLAP be continued in the schools where it is currently operating and be extended to other primary schools for teaching English in Standards One to Three on self-selection basis.
- Both direct radio broadcast and cassette tapes be made available for schools which will need to use the RLAP approach.
- In-service courses for teachers planning to use the RLAP approach be organized as soon as possible.
- The Kenya Institute of Education study the lessons learned from the RLAP for improving some aspects of other radio lessons produced at the Institute and vice versa.
- The Ministry of Education, Science and Technology initiate discussion between the Kenya Institute of Education, The Jomo Kenyatta Foundation and the School Equipment Scheme to advise the Ministry on the production and distribution of support materials for radio lessons (printed materials as well as tapes). The printed materials should be produced cheaply and bound.

- In view of the above recommendations, more professional staff be employed to strengthen the radio language section at the Institute especially in the area of assessment and evaluation.
- Teacher Education Institutions start a course in the area of technology of education related to the use of instructional radio.
- At some future date, the Kenya Institute of Education should investigate the impact of RLAP on the graduate of the programme especially in the area of Communication in the Classroom in Standards Four and Five.
- In schools where radio reception is poor, radios with powerful receivers should be supplied.
- Further study be undertaken to investigate the effectiveness of cassette tapes vs. direct radio broadcast.
- Discussions should be initiated to determine ways in which the RLAP approach could be used to teach Kiswahili in primary schools.

Osodo (1985) studied the effectiveness of radio lessons in history in the primary school. The major goal

of the study was to assess the attitudes of pupils towards history radio lessons and to find out whether radio-history lessons provide a kind of experience that text! and teachers cannot provide; to find out whether the distribution of teacher notes, visual materials, radio sets is adequate and to find out the problems associated with the use of radio as a medium of instruction.

Osodo found that radio-history-lessons were not only effective, dynamic, stimulating and educative, but they were also popular with the teachers and pupils alike. This approach was found to be a dynamic method of imparting knowledge skills and attitudes to the pupils in primary schools. Based on these findings, Osodo recommended that the taped radio-lessons should be reviewed from time to time in order to make them current and more relevant to the syllabus. The supply of teachers notes, visual aids, etc... should be regular. Schools with many in large stream should be supplied with at least two radio sets. There should be a close contact between central planners and those in classroom situations - the teachers, and teachers should try to assess their pupils regularly.

Mainje and Obiero separately evaluated the effectiveness of radio lessons in the teaching of English

in grades III and VI respectively in two rural districts of Kenya. Both researchers found that one of the limiting factors in making radio lessons effective was lack of training and preparedness on the part of teachers in the utilization of the radio. The other limiting factor was the non-availability or short-supply of support materials. A third factor that seems to limit the effectiveness of radio lessons is poor reception from the broadcasting stations.

Walugere (1980) in his study on the effectiveness of radio programmes in science teaching in Uganda came to the same conclusions as Osodo and Mainje. He found that radio lessons were effective in teaching science in Uganda when the programmes were properly utilized. However, he noted that in Uganda " the supporting materials are poorly distributed and are lacking in schools. In some cases radios are not enough to cater for the need of students and teachers.

The majority of the teachers do not prepare lesson plans for radio lessons, and do not follow up the lessons. At the same time, pupils are not adequately prepared for the radio lessons, thus, the programmes are not efficiently utilised because few pupils can follow without the help of the teachers. Therefore, the programme utilisation is low."

Walugure concludes from his findings that:

For maximum utilisation of the radio programme, there should be:

- Sufficient and relevant training for both Radio and classroom teachers.
- More and relevant support materials should be supplied to schools, this include not only the Broadcast to school notes, but also other support materials or usual aids.
- The Radio Programme should pay special attention to pupils activities/experiments during the lesson, pupils should be encouraged to participate fully during the lesson.

Chimerah studied the role of the classroom teacher in instructional radio lesson. He found that where instructional radio was properly used it stimulated the teacher to produce work of a higher standard.

Examples of distance learning to meet specific needs can be sited in Tanzania (training of teachers), Lesotho (assisting private candidates to pass examinations, rural women to acquire practical skills, teachers to improve their qualifications), Kenya (Correspondence

courses for teachers and school broadcasts). The following radio project in Tanzania illustrates how the radio broadcasting was utilized in the instruction of teachers:

In 1974 Tanzania mounted an effort to achieve universal primary school enrolment by 1977, despite serious resource constraints. It was estimated that 40,000 teachers would be required to reach the goal, and that it could not be accomplished through conventional teacher training methods. Further, the pool of secondary school leavers who might be pressed into service as primary school teachers was small, because the government had focused on developing primary and adult education. Thus, Tanzania needed a new strategy to fill its primary teaching ranks. It chose to use primary school graduates with some experience in adult education and to train them on the job.

Trainees had to be between 17 and 28 years old, live in an area where teachers were in short supply, and have taught adult literacy for at least two years. The strategy consisted of providing an initial six-week residential training course, followed by supervised primary school teaching. While working in the schools and teaching 22 periods a week, trainees followed correspondence courses and listened to related radio programs. In addition,

opportunities were provided for them to meet and discuss their work with fellow trainees and supervising head teachers. Trainees were examined each term, and a final, nationally organized, examination was administered at the end of the three-year course. Of the 45,534 students who began the course between 1976 and 1978, 37,325 (81.9 percent of those who started) completed it, and 35,028 (77.2 percent) passed their final examinations, thus gaining qualified teacher status.

A comparison of these trainees with a control group who attended a regular teacher training program found the first group performed slightly less well in academic knowledge, but better on measures of classroom behaviour. The combination of the practical classroom apprenticeship with study at a distance appeared to be an effective way to respond to the critical primary teacher shortage. Further, the strategy realized important savings, since teachers are employed during their training period and the costs of residence at training college is minimized. The costs of the distance teaching strategy in Tanzania were calculated to be approximately one-quarter the cost of conventional teacher training.

The approache used in the Tanzanian project may

be described as traditional educational broadcasting. A more improved approach is to be found in the Radio Language Arts Project in Kenya that we have already discussed. This approach may be referred to as 'interactive educational radio'.

Interactive radio differs dramatically from traditional educational broadcasting in its reliance on student participation, or interaction, with the program. Unlike the instructional design of traditional educational radio that encourages passivity as students listen to lecture-style instruction, the design of Interactive programs makes creative use of radio. The experimental Kenya Radio Language Arts Project (RLAP), a good example of interactive radio, involved primary school children as active participants in a pedagogically sound dialogue that taught the Kenyan English language curriculum.

What might have looked like pandemonium in a RLAP classroom was actually a well-designed, tightly-controlled lesson called "English in Action" whose key attribute was that it involved all students actively in the learning process. The thirty-minute daily broadcasts, which were punctuated by music and little dramas, incorporated regular pauses for the children to respond

and receive immediate reinforcement for answers. Responses could be sung, spoken, provided in writing or through physical action. Typically, children were given the chance to respond over one-hundred times during each thirty-minute period. When interactive radio was compared with textbooks in a grade-one classroom, it was found to be more effective in raising student achievement.

The effort to involve children in a conversation with the radio demands precision timing and careful observation of how children respond to radio prompts. RLAP designers have achieved this precision through trials, observations, repeated pretesting, and classroom monitoring. Teachers tended to be supportive of the interactive radio experiment; they saw the program as a way to enhance their work, and not as a way to replace them in the classroom. With assistance from teachers' guides, they worked along with the radio programs, calling on individual children as cued by the radio, overseeing written responses, and providing closer overall supervision than would have been possible without interactive radio.

Experience has shown that interactive radio can be used effectively by untrained classroom monitors, as well as trained teachers, with little training or special

support. Further, once radio lessons are developed, the annual per pupil cost is modest, since few supplementary learning materials are required.

Laboratories and Science Equipment

In recent years Governments in Africa have been concerned with the development of science and technology in their states. Fears have been expressed that unless science and technology education improves, Africa as a region, is likely to remain undeveloped technologically. It is therefore important to examine some of instructional resources that may affect science education in particular. Laboratories and science equipment are the two major resources that may have a significant influence on the teaching of science. Four papers were reviewed in this area.

Musoko (1980) studied the role of laboratory in the teaching of ordinary level physics in Kenya secondary schools. She found that the conditions of physics laboratories in Kenya is "far from being satisfactory". There are few laboratories in schools especially in unaided schools. This has forced most of the unaided schools to teach mainly Arts subjects.

Presently 50% of Government-aided secondary schools have two physics laboratories, one for A-level physics and another for O-level physics. About 35% of the private schools have only one laboratory for all the three science subjects. Many of the Government schools have two laboratories for the three science subjects. Most of Government schools have enough laboratories to enable them to do practical work. But many private schools lack them, thus they tend to offer General Science.

34.3% of the physics teachers have access to 30.4% of all available laboratories for O-level physics, while 37.1% have access to 37% of the laboratories for both O and A-level physics. As to the quality of the laboratories, Musoko found that most of them are fairly equipped, but apparatus for experiments or for demonstration are in short supply; thus pupils do not get sufficient practice with the apparatus. The cost of buying science equipment for the laboratories is very high. Most schools cannot afford to buy the required equipment. Because of this, individual practical work is almost impossible. Demonstration and teacher centred work is more common than group work. This means that pupils participation in science is minimal. This has contributed to poor performance at O-level in the practical examination.

Azeke (1975) discusses and gives suggestions on how to improvise science laboratories for primary and secondary schools at low costs for the learning of General Science in Africa. He says that the primary need of the school willing to start the study of science is a store place - the Store Room. This is a place where chemicals, reagents, equipments, etc... are to be stored when they are not in use. The Store Room need not be extra large; a room dimension of a normal classroom which can accommodate thirty to thirty-three children will serve.

The Trolley (Mobile) Laboratory would be ideal for schools that have not had the means of building a standard laboratory. It would be a mobile laboratory that would travel with the teacher from class to class wherever he has his lesson. Rather than children moving to the laboratory for their practical lesson, the laboratory will be brought to them.

The Mobile (Trolley) laboratory is cheap both in make and material costs. First one needs either two or four old bicycle wheels with the tyres, tubes, the spoke and the hub casing. Build a wooden table with two tiers, and then fix it to the framework with bolts and nuts into the wheels, and you get a simple trolley. The

Trolley Laboratory is mainly and exclusively for the Teacher's Demonstration experiments, it can work with a class of twenty-four to thirty to work in group of six or four children.

The Trolley need not be loaded with materials not in immediate use. It would be most useful if it carries only those reagents and chemicals, apparatus, water supply, bunsen burner and gas unit needed for one class lesson or two running sessions.

One of the most significant innovations in the production of science equipment in Africa is the School Equipment Production Unit (SEPU) in Kenya. Carroll (1975) says that the idea behind S.E.P.U. is that Kenya's Science Teachers should be supplied with inexpensive but flexible scientific apparatus. In order to achieve this, a partnership of three components was established; a Science consultant, who designed the apparatus; a Workshop where apparatus could be made, and a Sales man, who would handle distribution of the apparatus to schools. The design of a Physics Kit was done by a Swedish Engineer, Mr. E. Bengtsson. This was followed by a design of a Chemistry-Kit.

The Chemistry kit contains apparatus for doing up to 100 experiments described in the various E.A.C.E. Science

syllabus. About half of it is glassware, and the rest when not in use is kept in position or stored in trays in a plastic mould inside a cardboard box. Each kit cost KShs. 255/= with cardboard box or KShs. 270/= with the wocden box.

The basis of the Chemistry Kit is the pegboard stand. It is stable and light compared to retort stand. The kit has other advantages, there is no bent glass tubing. Thus it is much easier to set up the apparatus and you don't need things like bee-hive shelves or gas jars. But, its relatively small scale makes it not very suitable for teacher demonstration experiments.

School Buildings and Facilities

Little is known about how the construction standards and upkeep of school buildings, the presence and condition of pupil desks and chairs, and the availability of proper ventilation and sanitation facilities affect the quality of education. The effect of poor physical facilities is perhaps primarily one of discouraging pupil attendance.

In any event, there is probably some threshold below

which inadequate facilities seriously impair the quality of education. Moreover, this threshold is quite likely not being reached in many parts of Africa, where dilapidated schools and the absence of usable school furniture and facilities are widespread, especially in rural areas. Inadequate maintenance and missing or broken desks and chairs are problems that have been aggravated by the current budgetary crisis, because in most countries, the responsibility for these items rests traditionally with government. The use of more local materials in the construction of school buildings and classroom furniture may make it possible to reduce construction costs and to transfer more of the responsibility for maintenance and repair to local communities, which is in line with the general trend toward greater local financing of the capital costs of primary education.

Exercise Books and Pencils

Exercise books and pencils are basic to the learning of literacy and numeracy skills. Writing is a productive form of literacy; it involves active creation of ideas and organization of information. To recover costs, some countries have transferred to parents the cost of these basic supplies. The wisdom of such a policy depends on the ability of parents

to pay. In certain rural areas where the private demand is weak, even limited cost recovery of this type should be considered with caution. An advantage of this approach, however, is that it lends some protection to the provision of these relatively inexpensive but pedagogically crucial inputs during periods of financial stringency. There is an urgent need for research in this area.

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