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# Improving Health Education in Kenya

## Abstract

*Adopting new health practices is not simply a matter of being told what to do and doing what one is told. The primary health care interventions that are currently being introduced in Kenya and developing countries to reduce infant mortality require parents to perform complex cognitive tasks. These involve making inferences from knowledge of human biology and disease processes that may not be acquired from health instruction provided in schools or through public health campaigns. What is needed to design more effective health education programs is a better understanding of the knowledge structures and cognitive strategies that are involved in comprehending procedures associated with modern health care practices.*

## Introduction

Although mothers' schooling has been correlated with lower infant mortality and higher life expectancy in developing countries, the processes through which schooling affects health status are still poorly understood (Cochrane, Leslie, & O'Hara, 1982; Grosse, 1982; O'Hara, 1980). Most explanations of the impact of schooling on health have emphasized intermediate outcomes of schooling such as access to wage/salary employment and migration to urban areas as the mechanisms through which health practices change and better health occurs. Little is known about the effects of the health instruction mothers have received in school, about what they have retained from such instruction, and how it influences the way they treat diseases in their children.

In Kenya, we have examined mothers' comprehension of oral and printed instructions for using commercial products for treating dehydration

due to loss of body fluids and salts during diarrhea. These products are readily available in rural areas as a result of government policies which have encouraged the private sector to dispense modern medicines so mothers can administer them at home. It is intended that the information required for their use be obtained either from the printed instructions that accompany the products, or orally, from the persons who sell them.

Our research focused on the knowledge mothers use in comprehending instructions for oral rehydration therapy (ORT). The instructions elicit knowledge integral to explanations of illness (and well being) as well as to relating treatment to the presumed causes of disease. Among mothers with little or no formal schooling, disease is attributed to causes located in the relationship between an individual and his social and spiritual environment, although this does not preclude recognition of biological causes as factors contributing to illness.

Better schooled mothers, we have found, not only give more specific descriptions of symptoms of diarrhea and dehydration, but their explanations of diarrheal diseases emphasize environmental causes, especially the contamination of water, food, and utensils, and unsanitary conditions, generally. They are more likely to employ notions drawn from Western folk medicine such as germ and dirt theories of disease causation which receive much attention in health education and home science instruction in primary schools. These notions are important in building an understanding of the relationship between the causes of disease and their prevention. In addition, they are important to comprehending and following certain procedures recommended for administration of commercial oral rehydration salts solutions to children; boiling water, for instance. However, germ and dirt theories are less useful for explaining other procedures involved in using these products, particularly those having to do with providing enough fluid and nourishment early in the course of treatment to stabilize the child's condition. Such procedures require a more profound understanding of the biological and physiological bases of diarrheal diseases as well as of how oral rehydration therapy works in treating the diseases and, thus, alleviating the symptoms of dehydration.

Findings are presented from three studies showing how mothers' understanding and use of ORT can be fostered by designing instructional materials that provide explanations of treatment procedures that make "sense" in terms of lay theories of disease causation. In addition, the study examined school health education programs that impart knowledge necessary for the adoption of new health practices. The first examined how schooling may influence the way mothers think about and treat diarrheal diseases in their children, and revealed that even mothers with relatively high levels of schooling combine ORT with administration of traditional medicines which

are likely to weaken a child's condition. A second experimental study was carried out to show how comprehension of procedures for using commercial ORT solutions might be facilitated by relating the instructions to medical knowledge acquired from schooling or from social experience. The third study demonstrated how teaching about ORT and other health topics can be improved by modification of the instruments now being used to assess learning outcomes and teacher performance in Kenyan primary schools.

### **Influence of Schooling on Causal Attribution of Disease**

#### ***Study of causal attributions***

The theory of causal attribution was formalized by Kelley (1973) and is concerned with the attempts of ordinary people to understand the causes and implications of events in their daily lives. This theory views an individual as a lay scientist who attempts to infer causes for observed events, using systematic rules and strategies for assessing information and making judgments involving uncertainty. Einhorn and Hogarth (1986), Hammond (1955), Kahneman and Tversky (1982), and Mackie (1974) have argued that judgments of causal relevance are generally related to whether the events violate expectations. Events that are part of some presumed background or "causal field" are judged to be of little or no causal relevance. Abnormal events generate causal interest.

A central assumption is that common-sense explanation involves a co-variational notion of causality. Formal inference rules allow attributions to be deduced from particular configurations of the consensus, distinctiveness, and consistency of the information. However, this model has shortcomings as a representation of the process of causal attribution. The co-variance principle based on multiple observations requires the attributor to apply rules that are essentially logical or probabilistic in nature. In many circumstances, a person makes a causal inference on the basis of a single observation which provides more certainty than consistency characterized by a series of events. Moreover, inferential processes do not necessarily involve the operation of formal rules of inference (Johnson-Laird, 1983). Everyday explanation diverges from scientific explanation in the manner in which we select from conditions that we choose to designate a cause of any event, although the selection of the cause from the range of conditions necessary for occurrence of the event may be orderly and rule-governed (Hart & Honoré, 1959).

Fieldwork was carried out in the Kenyan village of Meto in Kajiado district in February 1986 to ascertain what problems literate and illiterate Maasai mothers experienced in comprehending instructions for using ORT solutions. Kajiado district with a population of about 150,000 has one of

the highest rates of infant mortality and one of the lowest rates of school participation in the country (Ole Sena, 1986, p. 3). Its inhabitants are primarily Maa speaking pastoralists living in temporary settlements in remote areas of the district or on group ranches and private plots near the district headquarters at Kajiado town, about 80 km south of Nairobi. Meto is the site of a rural training centre, a village polytechnique, and a primary school. It is the terminus of a pipe line providing water from mountains in neighbouring Tanzania. For this reason, the area is settled by pastoralists in the dry season.

Fifty-two mothers were asked questions about the size and characteristics of their families, where they obtained water, and whether they did anything special to it before drinking; information was also elicited about the frequency and nature of sickness among children in the village clinic, attitudes toward and uses of traditional and modern medicine, beliefs about the causation of diarrhea, and the identification of symptoms and usual treatments. Information obtained from these interviews was used to construct models representing how mothers think about treatment modalities in relation to the causation of diarrheal diseases (Patel, Eisemon, & Arocha, 1987a).

Unschooling Kenyan mothers typically treat diarrhea by giving herbal medicine and purgatives together with sheep fat as the example given in Figure 1 illustrates. The figure gives a detailed analysis of the semantic representations of a verbal protocol describing the causal (CAU), conditional (COND), and temporal sequence (ORD:TEM) or association (ASSOC) of events mentioned in relation to diarrhea.

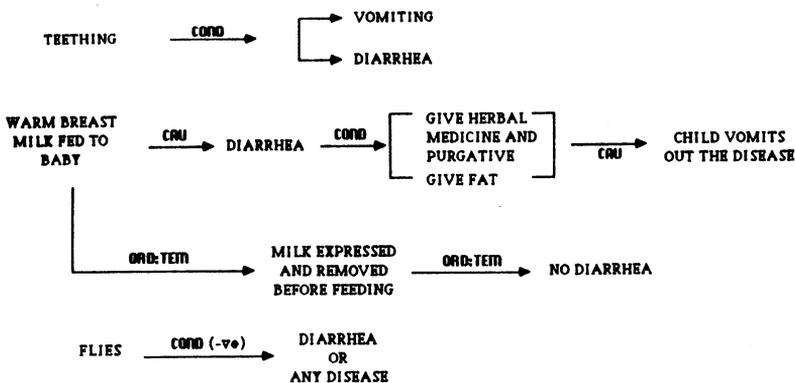


Figure 1: Structural representation of causality and treatment of diarrheal disease by an unschooled Maasai mother (#2)

In this example, taken from a twenty-year old unschooled mother with two children living in a traditional Maasai encampment, teething and warm breast milk are believed to be associated with or to be the cause of diarrhea in her children. Teething is indicated as an accompanying condition but not a necessary one for diarrhea and vomiting to occur. In other words, teething does not cause diarrhea, but diarrhea is always associated with teething. Asked whether the presence of flies has any role in diarrheal illness, the mother neither linked this condition to diarrhea nor to any other physiological or environmental condition considered to accompany the disease, even though in Maasai encampments human beings live with cattle, and flies are always present.

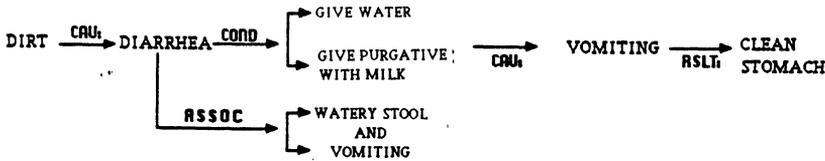
Warm breast milk is identified as the most likely cause of diarrhea. The mother explained that breast milk is warm when her breasts are exposed to the hot sun. Babies have difficulty in digesting hot mother's milk. Cow's milk is kept cool in calabashes placed inside the mother's *manyatta* (house made of cow dung and waddle). Babies do not get sick from drinking cool cow's milk. If some "warm" milk is removed after a woman has walked long distances in the hot sun, babies do not have diarrhea.

When children receive warm breast milk and develop diarrhea, they must be given herbal medicine, including *iseketek*, a strong purgative, mixed with cow's or sheep's fat. The administration of some indigenous medicines, of course, may significantly worsen the child's condition through mechanisms that are believed to promote recovery. They work by expelling the disease from the child. The strength and frequency of administration of the purgatives is determined by perceptions of the severity of the illness; stronger, more frequent administrations are given when the child is severely ill.

### *School effects*

Some schooling seems to profoundly influence how mothers think about diarrheal diseases although this cannot necessarily be attributed to the formal instruction in biology and health which they have received. In Kenya, health subjects are introduced only in the upper standards of the eight year primary cycle in which English is used as the medium of instruction. However, students in the lower standards are given much informal instruction about health and personal hygiene. They are, for instance, expected to wear clean uniforms to school. The cleanliness of their clothing, hair, and finger nails is frequently inspected; and they are often required to clean the school compound, classrooms, and pit latrines, especially as a punishment.

Below we have presented a protocol from a mother with six children who left primary school after three years of instruction (Figure 2).



**Figure 2: Structural representation of causality and treatment of diarrheal disease by a Maasi mother with three years of schooling**

Environmental conditions are indicated as the cause of diarrhea. In contrast to the unschooled mother, she explicitly linked diarrhea to a description of its symptoms, emphasizing watery stools, perhaps because it suggests to her the need to increase the child's intake of water, milk, and other fluids. This treatment is combined with administering purgatives to clean the child's stomach which will exacerbate rather than alleviate symptoms that are identified with the disease. The apparent contradiction may stem from the fact that while the manner in which traditional treatments work is understood, those acquired from schooling are not.

Like many mothers with little formal schooling, this woman has developed an explanation of diarrhea that has little utility for understanding home treatments based on the recognition that fluid retention and nourishment are needed for recovery. The knowledge that environmental conditions are somehow implicated in causing illness does not necessarily motivate preventative measures.

Higher levels of schooling produce better descriptions of the causes of diarrhea and its symptoms, and strengthen beliefs in the effectiveness of some treatments derived from modern medicine (Figure 3). Contamination of food and water caused by flies and dirt are mentioned by this mother as conditions associated with diarrhea. Although she makes no reference to "germs" in her description of disease processes, many of the mothers in this study who had more than six years of primary schooling used germ theories to connect conditions associated with diarrhea to causes as well as to treatment, e.g., giving boiled water to a sick child. The mothers often administer oral rehydration salts solutions to their children and/or purchase commercial mixtures from local shops as this mother does. Home preparation of oral rehydration salts solutions is dealt with in the standard VII primary schools syllabus, and in recent years the topic has been selected for examination questions in the health science paper of the Kenya Certificate of Primary Education Examination. From schooling and from other sources mothers learn of the importance of ORT and incorporate what they know about it into home treatments, but highly schooled

mothers do not give up traditional remedies. Rather, ORT is added to their repertoire of traditional treatments as its relationship to the causes and symptoms of diarrhea is not well understood.

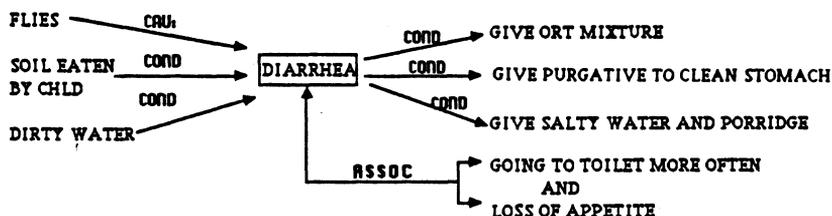


Figure 3: Structural representation of causality and treatment of diarrheal disease by Maasai mother with 8 years of schooling

### Research on Use of ORT Solutions

Information about ORT is disseminated in rural areas in many ways – through mass media campaigns (especially radio instruction); the distribution of flyers, posters, and printed media; demonstrations by village health workers; or some package of these techniques (USAID, 1985). The strategy adopted for popularizing ORT is determined by what mothers are to be taught to do. If preparation of ORT solutions from local ingredients is taught, then emphasis is usually given to face-to-face instruction with radio and other media having a supportive role. More innovative strategies for popularizing ORT have involved the use of traditional healers as instructors to generate greater acceptance of the therapy, particularly among unschooled mothers. In addition, pre-mixed ORT solutions are distributed through the private sector with shop owners and clerks having the responsibility for educating mothers as to their use.

Pre-mixed ORT solutions are available in many parts of rural Kenya where they are sold by the packet in *dukas* or small shops that stock canned goods, cooking utensils, tobacco, soft drinks, and some pharmaceutical products (i.e., aspirins, malaria pills, and treatments for intestinal worms or upset stomachs). In early 1986, at least five kinds of ORT packets were being sold in the country, some of them only in major urban areas serving as test markets. Most products are locally manufactured or packaged by firms that are subsidiaries of international pharmaceutical corporations. The printed instructions that accompany the products are usually developed abroad, and only one product is sold with a Kiswahili translation of the English instructions. While Kiswahili, the country's official language, is not the mother tongue of most Kenyans, it is a compulsory subject in primary school and is the *lingua franca* of daily commerce.

### *Informal instruction*

Most instruction about the use of ORT packets occurs in the context of exchanges between sellers and purchasers of these products. A February 1986 survey of thirty *dukas*, located in and around the town of Kajiado, indicated that thirteen distributed ORT packets but that only one brand of product was available.

Information about ORT preparation and administration is normally obtained in one of three ways, from (1) self study of the printed instructions and illustrations contained on the packet; (2) explanation of the instructions by the seller who may, in addition, make reference to information appearing on the cartons containing ORT packets, and in posters distributed to shop owners (which were not displayed and, with difficulty, found only in one shop in Kajiado); and (3) communication of the instructions by individuals who have studied them or obtained explanations from sellers of the products to the eventual user, usually a family member. In other words, the information is derived directly from the printed text and accompanying illustrations. The illustrations describe a portion of the set of instructions; specifically, mixing the content of the packet with boiled water and the administration of the solution in a tumbler to a child. Information about proportions, frequency of administration, and precautions cannot, of course, be easily provided or reinforced with graphics.

Sellers were asked to read the instructions and explain how to prepare and administer the solutions to an infant. Most sellers simply referred the purchaser to the illustrations. Asked to read the instructions aloud, sellers usually searched the text for information as to the frequency of administration ("You mix and give two or three times"), without noting that the amount of fluid and frequency vary with the age and size of the child, or that a child should be given more fluid at the beginning of treatment, and that treatment should continue for more than one day.

### *Comprehension of printed texts*

Two experiments (Eisemon, Patel, & Ole Sena, 1987) were designed to assess how schooled mothers process information contained in printed instructions for preparing ORT mixtures. The product studied required mothers to perform a number of procedures involving measuring, mixing, and administration of the medicine in recommended quantities to a sick child. These, in turn, involve mothers' recognition of the various stages of diarrheal dehydration, intervention at an early stage, and maintenance of hydration and nutrition during recovery. In sum, what is needed is an explanatory knowledge of how the medicine is supposed to work in treating diarrheal dehydration and the capacity to make inferences from this

knowledge, in addition to skills in preparing and administering modern medicines. The experiments were carried out with 40 randomly selected Maasai mothers, having at least one child less than five years of age, and who had obtained a minimum of six years of primary schooling and were living in or around the town of Kajiado.

The mothers ranged in age from 19 to 59; the average age being 29. Most had three children. Three fourths (75%) had obtained some secondary education, and 36% completed O level studies. Ten mothers were involved in some form of wage employment. All had previous knowledge of ORT and had used pre-mixed ORT packets.

It is estimated that about 60% of Maasai of school age are now enrolled in primary schools in Kajiado district (Ole Sena, 1986). Female participation rates are still below levels for males – approximately 1.5:1 – in part due to the fact that little official encouragement was given to the education of female pastoralists until very recently. Six years of primary schooling was adopted as a criterion for selection for several reasons. Four to six years of primary schooling is usually considered sufficient to acquire functional literacy (Hartley & Swanson, 1984, pp. 26-37). Moreover, six years of primary schooling implies at least three years of instruction in English as the medium of instruction, and six years of study of Kiswahili as a subject. In other words, a school leaver with six years of primary education should be literate in English and Kiswahili irrespective of the school attended.

Below are summarized the findings from the two experiments beginning with an analysis of mothers comprehension of the original instructions.

### ***Comprehension of original instructions***

Two texts were used for the first experiment, one of which consisted of the printed information in English as given by the manufacturer along with the graphic information that appeared on the packet. This information was translated into Kiswahili to create a second text to determine whether this improved comprehension. The text was not translated into Maa because this language is seldom used for printed communication. Sentences in the text were numbered to facilitate recall of information and were typed to enable reading. Visual cues (e.g., bold letters) were added to correspond to the original instructions.

The graphics that accompanied the instructions consisted of five pictures, the first of which depicted a pot of water set in a fire with the instruction: boil water. The next advised the user to cool the water by

removing the lid. The third and fourth pictures indicated that the cooled water should be poured into a tumbler, all powder from the packet added, and the contents stirred. A mother is shown giving the child a tumbler of the mixture in the final picture with the caption: give slowly.

Mothers were required to describe the pictures and to read the instructions for the product aloud. Seven questions were constructed in Maa to examine comprehension of the texts. These were of two types. The first required the mother to recall information from the text (e.g., "How much water do you mix with the powder?") while the second had to be answered in inferences from prior knowledge (e.g., "Why shouldn't you boil water after adding the powder?"). Finally, mothers were asked to translate a line in the text into their own language.

Protocols obtained from the administration of the two texts were scored for the correctness of responses by a Maa speaker who was not involved in the collection of data. For example, "What steps do you follow to make a mixture of (the product)?" was the first question asked. If the mother indicated that "you boil the water and wait until it becomes cool," she received a score of four out of a possible ten because only two of the five steps in the preparation of an ORT solution were mentioned. Answers to some questions had to be judged more subjectively. Asked to explain why the powder and water should not be mixed prior to boiling, one mother replied that "boiling the mixture would remove the medicine." This answer received a perfect score of ten because boiling would decompose the solution and some of it would evaporate.

The comprehension scores for the 20 subjects given the original instructions were low. The ten administered the English texts scored a mean of 52 of a possible 70. Those receiving the Kiswahili texts did not score significantly higher ( $\bar{x}=53$ ). Schooled mothers found the printed instructions difficult to comprehend for a number of reasons. Some vocabulary and units of measure were unfamiliar to them. The frequency of administration was presented in a way that required the user to make very difficult calculations of the amount to be administered to infants and to children over five years of age. Furthermore, the procedures for preparing the mixture in the printed text did not follow a temporal or logical order, nor were the precautions listed in order of their importance to the user.

When mothers had problems in comprehending the instructions, it was usually because they lacked knowledge needed to construct explanations that "made sense" to them. For example, many mothers felt that in preparing the mixture, the medicine should be added to water prior to boiling, ignoring information which can only be inferred from the printed instructions. Well-schooled mothers made the necessary inference if they possessed the knowledge to explain why boiling should precede mixing the

medicine with water. Mothers with little schooling speculated that the order of procedures might have something to do with ensuring that the medicine was strong (e.g., "It may kill the healing power of the powder."). Those with more schooling used evaporation and other explanations drawn from school science instruction. Similarly, mothers were more apt to follow instructions to boil water if they employed germ or dirt theories to explain the necessity of the procedure in terms of their beliefs about how diarrhea is caused. Boiling made little "sense" to mothers who did not use biological causes in explaining illnesses, including some who identified environmental factors, such as dirty water, as being associated with disease.

More serious difficulties were encountered in reconciling information about the maximum number of administrations in any twenty-four hour period with instructions to give babies boiled cooled water whenever thirst was apparent. Although mothers seldom thought that the medicine would suffice to promote recovery, combining this treatment with increasing the child's intake of fluids presupposed that mothers would know that the child's balance of body fluids should be restored as soon as possible to alleviate the symptoms of dehydration.

While no set of instructions for using this or other modern medicines can be designed well enough to close gaps in important prior knowledge, such instructions can be greatly improved. It was found that good graphics are very effective in communicating information about the temporal order of procedures in preparing and administering medicines. Unfortunately, some necessary information about correct dosages and precautions are difficult to communicate with graphics.

### *Comprehension of revised instructions*

A second experiment was designed to examine ways of improving the printed instructions through changing the language of the text, simplifying factual information, using colloquial vocabulary and familiar units of time and measurement, and arranging information into a temporal or substantive hierarchy of tasks. In addition, we sought to improve the texts by incorporating explanations of treatments and individual procedures that were likely to "make sense" in terms of prior knowledge obtained from schooling or which was embedded in indigenous medical practices. For example, instructions to continue feeding were combined with an explanation that the sick child needs energy to get better. This is the rationale that African mothers give for mixing herbal medicines with fat and other foods.

Comparisons of mothers' comprehension of commercial instructions with instructions which we revised showed that simple changes in text

construction produced gains in their ability to recall and make appropriate inferences from printed information, especially among mothers with little schooling.

Twenty mothers who received revised instructions in English and Kiswahili received higher scores for the seven comprehension questions we have described previously. The ten administered the English texts, for instance, obtained near perfect scores ( $\bar{x}=66$ ). The absolute differences in the mean scores across text and language conditions are large and statistically significant ( $F=5.51$ ,  $p<.001$ ).

The lexical and semantic characteristics of the original and revised texts were examined, using techniques of propositional analysis to determine how the information presented in them was represented (Patel, Eisemon, & Arocha, 1987b). The two sets of instructions were found to be similar in complexity. In both, essential information was embedded in many conditional statements requiring the reader to re-construct information. The principal difference was that the revised texts offered more explicit guidance as to the temporal ordering of procedures to facilitate encoding and accessing of the information.

The mothers' responses were analyzed in terms of the proportion of propositions (semantic units) recalled or inferred from the texts compared to the information obtained from the illustrations and other sources. Mothers who received the original text made little use of the information it provided. Less than half (40%) of the propositions they recalled or inferred were derived from the printed instructions. Almost all (95%) of the information used by mothers who were given the revised instructions was obtained from the text. Moreover, the proportion of mothers whose answers correctly matched the propositions contained in the printed instructions was 100% for four of the five questions which required recalling or inferring from such information.

### **Improving Health Education**

While modifications in the design of printed materials may increase comprehension of instructions for using ORT products, effective treatment requires some understanding of the causes of diarrhea as well as of how the therapy works to alleviate dehydration and promote recovery.

Mothers who have attended school may understand that diarrhea can lead to severe dehydration. They know that diarrhea weakens a child's condition. They may routinely administer oral rehydration salts solutions to their children. However, as we have noted previously, mothers with complete primary education are often unable to explain why the solutions

are necessary and effective; and they sometimes combine this treatment with other harmful measures such as administering traditional purgatives and discontinuing feeding.

Health information is a compulsory part of the final examination administered at the completion of primary school. The test items currently used to determine whether students know how to prepare oral rehydration salts solutions from household ingredients, for instance, requires them to select the correct answer from one of the following choices: plenty of fruit juices; breast milk regularly; plenty of water with a little sugar and salt; or plenty of milk and porridge (KNEC, 1985). The administration of any fluids and nourishment is essential to recovery. School instruction is an important source of confusion about the effective treatment of diarrheal dehydration. When teachers prepare their students for this and similar examination questions, they drill them on the correct answer. Similar drill techniques are often used by adult educators and health care workers.

#### ***Research in health studies***

In a third study (Eisemon, Patel, & Abagi, 1988), we sought to demonstrate how the test items used in the Kenyan primary school examination to assess knowledge of ORT, immunization, control of communicable diseases, and child nutrition could be changed to encourage teachers to explain disease processes so that students may better understand the importance of preventative measures and effective treatments.

Recent research on achievement testing (Glaser, Lesgold, & Lajoie, 1985) has drawn attention to the need for a better understanding of what test items actually measure. This is not revealed. Glaser *et al.* have pointed out, by present testing technologies which are oriented to analyses of item difficulty, discrimination, scaling and norming, and other procedures associated with instrument design and administration that, "In order to ascertain the critical differences between successful and unsuccessful student performance, we need to appraise the knowledge structures and cognitive processes that reveal degrees of competence in a field of study" (p. 1). Although testing theories propose diagnostic evaluation as a use of achievement testing, this is often carried out instead in the form of student selection and assessment of teacher and school "effectiveness." Achievement test results indicate what a student should know based on what someone has determined the student should have been taught. They do not provide many insights into the knowledge structures students possess or into the cognitive strategies they use, or into the kinds of instructional experiences they have had.

### *Revision of examination questions*

The health related questions given in the 1985 Kenya Certificate of Primary Education (KCPE) *Sample Papers* were extracted and compared to those which appeared in the mock KCPE examinations administered in Nairobi schools in 1985 and 1986. Five of these questions were selected for study and subsequent revision on the basis of the likelihood that they (or questions on similar topics) would be among the ones included in the Science and Home Science papers in the 1986 examination scheduled for November 1986.

The five questions dealt with nutrition, nutritional diseases, control of communicable diseases, and treatment of diarrheal dehydration. They covered several sections of the Science and Home Science syllabi used in the upper primary standards, and were related to important objectives of instruction. For example, school leavers are to be taught to "classify locally available foods into the three food groups, identify nutritional (deficiencies), plan and prepare balanced meals, diagnose common diseases, immunize and provide proper care for babies, and demonstrate an understanding and practice of preventative health measures" (Jomo Kenyatta Foundation, 1986, pp. 158-61, 282). Most of these health subjects are considered in Standard VII or in earlier standards, and merely reviewed in the final year of instruction.

It is difficult to know how the Kenya National Examinations Council might have classified the five questions in terms of the kinds of cognitive skills and knowledge required to obtain correct answers. Three seem to require recall of descriptive information to varying degrees. It is essential, of course, that students be able to recall information from the health instruction they have received if the knowledge is involved in the adoption of better health and nutritional practices. What is crucial is that the knowledge elicited be important to target behaviours in the sense that it is central to making appropriate inferences. To put it another way, the knowledge required for a correct answer should be fundamental to how students should think about something that should be significant to them. That the knowledge recalled is factual is less important than whether it is useful for reasoning in daily life.

The five original questions were transformed into ten questions which assessed competency in the same knowledge domains. The revisions followed two principles of item construction loosely drawn from Glaser's cognitive theory of the measurement of achievement to which reference has already been made, namely, that the knowledge elicited should be: (1) pertinent to structures necessary for integrating existing and new knowledge; and (2) explicitly related to the competent performance of some target behaviour. Thus, the first question about *bilharzia* (a parasitic disease) was

expanded into four questions about nutritional and communicable diseases, with the possible answers requiring students to select the correct cause and method of transmission of each of the diseases. The question on ORT was revised to make it clear that the "wrong" answers were wrong because they were equally suitable for treating other diseases. (For example, "plenty of fruit juice" could as well apply to treating a baby suffering from a vitamin deficiency as to treating one suffering from dehydration.) The original question seemed to follow our principles in other respects.

### *Demonstration study*

A demonstration study was carried out in two Standard VII classes in a Nairobi school whose students generally do well in the school leaving examination. The school places among the top 10% of the Nairobi Council schools in the proportion of its students who obtain places in government maintained secondary schools, about two-thirds in 1985. More than one thousand students attend the school. The majority are children of civil servants and members of the armed forces. Compared to other schools in the country, this school is well equipped with all-weather classrooms, enough benches and desks to accommodate all students, and multiple copies of student texts. In addition, all teachers are certified to instruct at the primary level.

The researchers visited this school in early November 1986 when Standard VIII students were being coached for the Kenya Certificate of Primary Education examination to be given later that month. It is usually difficult for researchers to have access to schools during the weeks preceding the examination. Preparation for the examination is serious business. Students in Standard VIII receive an additional day of instruction at the school beginning in September. Many are also coached by private tutors after school, some of whom are their teachers, although this is illegal. The day preceding the initial visit, one Standard VIII student experienced an anxiety attack from the pressure and had to be sent home.

Two teachers were needed for the experiment. One to teach the students to answer the original set of questions and the other to teach the revised set. It was anticipated that it would be necessary for the teachers to plan two forty-minute review lessons prior to the administration of the original and revised questions to both Standard VIII streams. The questions were printed in booklets with answer sheets similar to the ones used for the mock examinations. The different question sets were given to the teachers; the one who received the original set did not receive the revised set and *vice versa*. The school headmistress instructed the teachers that they would be held personally responsible for the performance of their students.

### *Drilling for the examination*

Initially, the two teachers did not know that they were preparing students to answer different kinds of questions and wondered why two review lessons might be necessary. The Standard VIII teacher who received the revised set soon appreciated that she had a more difficult task. Both teachers were given photocopies of the relevant passages in the health science texts for reference in preparing their lessons. The primary school teachers gave the impression of being very efficient in selecting information for lesson presentations generally, not just in reviewing subjects that had been previously considered. The scope of the school syllabus, the absence of textbooks, and methods of assessment combine to ensure that most teaching is restricted to examination essentials.

An important difference between the lessons prepared for this study and those observed on other occasions was that much greater use was made of the school texts. Lack of textbooks has been identified as a key factor in explaining the lower achievement scores of students in developing countries (Heyneman & White, 1986). Yet even in classrooms in which multiple copies of textbooks are made available to students they are often not used for instruction (Eisemon, 1988). Teachers rely on the syllabus, notes retained from teacher training, mock examination papers, and examination guides in preparing lessons. Review lessons are particularly likely to be taught without reference to textbooks.

The lessons given in the Nairobi school did not require students to study from textbooks, but teachers did use the teacher guides and photocopies of student texts in preparing their lessons. Since most of the content of all four of the review lessons was more pertinent to answering the revised questions, it is thought that changes in examination questions of the kind that were proposed increase teacher use of texts for lesson preparation. More specifically, these changes are likely to encourage teachers to understand what they teach well enough to construct explanations for students.

### *Test administration*

Students were administered both sets of examination questions, the order depending upon whether their teacher had received the original or the revised questions. It was expected that the students would perform differently based on the different ways teachers had prepared them to answer the questions. However, this could not be determined since the teachers exchanged examination questions and both focused their teaching on answering the revised questions. The seriousness with which they approached this task was evident in the high scores of the Standard VIII students. Average scores exceeded 80% for all four administrations.

The main purpose in conducting this study was not, of course, to boost the students' examination scores. Instead, the concern was with improving health education in primary schools and making it more useful to students. Five children were selected from each of the two Standard VIII streams and were interviewed to find out how they answered the examinations, i.e., what knowledge they used and how they organized this knowledge into explanations of disease processes from which principles could be drawn to guide health behaviour. The fact that students are able to select a correct answer from choices presented to them tells little about what and how they have learned.

Analyses of the interviews suggested that the instruction the students received imparted more than mere facts. Particularly interesting in this connection were the responses of students to the open-ended questions on diarrheal diseases. One student, Caroline, for example, answered the original and revised ORT questions correctly, the chief difference between these questions being that explanations of the treatments were provided in the hope that teachers would explain the importance of loss of fluids and salts. Caroline, a 14-year old girl, obtained a ranking of 402 out of the more than six hundred Standard VIII students who took the most recent zonal mock KCPE examination. Asked to explain why a solution of water, salt, and sugar is effective in treating severe diarrhea, she replied:

Caroline:           When you have diarrhea you produce watery stools, and then one is very weak and loses water.

Interviewer:       Yes . . .

Caroline:           Your body is a system of continuity and balance. There must be balance between what you eat and what you take out. You must eat and drink enough. When you have diarrhea you lose a lot of energy, and sugar and salt are necessary for energy and fluid balance . . .

Interviewer:       What do you think causes diarrhea?

Caroline:           Maybe we don't have good latrines or clean water. . . . You must have good latrines and fresh water. We should have many pit latrines. Clean ones. And we should have clean, fresh boiled water.

Caroline gave correct answers because she understood *why* they were correct. Her explanation is paraphrased from a portion of the teacher's lesson which is taken from a health science text, and is similar to the ones given by other students. The notion that ORT salts solution restores a food and

water balance in the body is central to recognition of the symptoms of diarrheal dehydration and to effective treatment. In other previous studies of Kenyan mothers' comprehension of procedures involved in ORT mothers who understood the treatment in any profound sense were never encountered.

### Summary

Previous research indicates that formal instruction influences beliefs about causation and treatment of children's illnesses and imparts reliance on modern health care. However, the studies that are summarized in this paper reveal that even mothers with relatively high levels of schooling, who have participated in adult health education programs, have difficulties in performing seemingly simple procedures involved, for instance, in the administration of commercial oral rehydration salts solutions. Although comprehension of these procedures can be increased with better printed instructions, this does not suffice to change health practices. In brief, while schooling imparts basic literacy skills and knowledge important to practices derived from modern science that improve health, functional use of schooling by adults has a great deal to do with the circumstances under which literacy and modern health knowledge is acquired.

Development of capacities to use ORT and similar medical technologies has been made the responsibility of teachers, village level health care workers, clinical officers, and other professionals who have conceived of health education, very simply, as exposing individuals to practices they should adopt in the belief that attitudinal and behavioural changes affecting their health status will occur. The findings of the studies reported here suggest that the knowledge involved in effectively using ORT for instance, is not merely a surface awareness of the symptoms and causes of diarrhea, and of the benefits of ORT, but an understanding of the physiological and biological causes of diarrheal diseases and an ability to explain the course of treatment. This research suggests that schooling can be effective in imparting the knowledge pre-requisite for ORT and other health practices. However, this will require profound changes in how health education is taught, especially at the primary school level. That, in turn, will necessitate changes in examination practices which foster explanatory instruction and understanding of disease processes and modern medical treatments.

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