Nutrition Education Series
Issue 18

First Technical Report of the New Unesco Project to Improve Primary School Performance through Improved Nutrition and Health

Unesco

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INTRODUCTION

The new Unesco Project to Improve Primary School Performance Through Improving Nutrition and Health seeks to increase the capacity of developing countries to strengthen primary school academic performance by improving nutrition and health status. This project is designed to complement the new Education for All initiative being launched by the United Nations Development Programme, UNICEF, Unesco and the World Bank which aims to provide primary education to all children in developing countries.

The first Technical Meeting of the new project took place at the Wenner-Gren Centre Foundation in Stockholm, Sweden from 3-5 April 1989 with funding and collaborative support from the Swedish International Development Authority (SIDA) and the Swedish National Commission for Unesco. Over 40 distinguished participants representing expertise in education, nutrition, public health, and development, along with representatives from United Nations agencies (the World Food Programme, the World Health Organization, UNICEF and the World Bank), government and non-governmental organizations contributed to the success of this meeting.

Three working groups were formed at Stockholm. The task of the working group on assessment was to help develop an assessment methodology that will facilitate the ability of Ministries of Education to collect and analyze information related to student nutrition/health status and academic performance. The Group was asked to address such questions as: what are the leading indicators of school nutrition/health status and academic performance? and what are the most appropriate and cost-effective measures that can be used to collect and analyze this information?

The working group on **interventions** was asked to recommend **strategies** and **low-cost, easy to implement technologies** that countries could use to address the nutrition and health problems of *at-risk* primary school students. The Group was asked to develop **planning guidelines** to help programme planners better design and implement interventions.

The working group on **research** was asked to develop a well-defined list of important research studies that link nutrition and health factors with school performance indicators. Criteria for selection includes the degree to which each study has the potential to yield outcomes that: (1) influence government or donor agency policy; (2) facilitate the design of interventions; and (3) improve scientific understanding of the causal relationships between nutrition, health status and learning outcomes.

The results of the deliberations of these working groups make up the contents of this document. The guidelines and recommendations set forth by the working groups go beyond the platitudes of some international gatherings. They include a level of specificity and detail that reflect the hard, unselfish efforts that participants at the Stockholm meeting displayed. Over the coming months, Unesco will begin to field-test these recommendations with its Member States interested in pursuing school nutrition and health programmes.

The Project's premise is that school nutrition and health ought to be an integral part of efforts to improve **educational quality**. Heretofore, it has been a relatively overlooked factor. However, an increasing and compelling body of scientific data, correlating children's nutrition and health status with learning outcomes, signifies that the international community can no longer afford to ignore this issue.

ASSESSMENT

ASSESSING THE PROBLEMS

INTRODUCTION

An array of nutrition and health-related problems are known to be common among schoolchildren in developing countries. These are protein-energy malnutrition; short-term hunger; intestinal and other parasitic infections; micro-nutrient deficiencies (i.e., iron deficiency anemia, iodine and Vitamin A deficiency); certain disabilities (i.e., visual, auditory, physical) and others (i.e., otitis media, diarrhoeal diseases, respiratory infections, lead intoxication).

Low rates of school enrolment, high rates of absenteeism, early school attrition, low school attainment or school failure are problems of growing magnitude in educational sectors of developing countries. A growing body of evidence linking *nutrition/health problems to educational outcomes* in developing countries is near conclusive in some cases (protein-energy malnutrition, short-term hunger, iron and iodine deficiency) and strongly suggestive in other cases (parasitic infections) (Pollitt, Unesco, 1989, in press).

Prevalence data on nutrition and health problems in the school-age group vary within and between countries; similarly, statistical data on educational outcome measures are also variable.

The Working Group on Assessment recognized that assessing school nutrition and health problems could be carried out at various levels. It developed *guidelines* for teachers and parents, mid-level health workers and medical doctors and trained laboratory professionals. The Group's recommendations also addressed the issues of sample size and school nutrition and health surveillance.

1. LEVELS OF ASSESSMENT

National Level

As a first step, appropriate representatives from the Ministry of Health (including people knowledgeable about infectious disease epidemiology, and nutrition problems) need to meet with Ministry of Education officials to discuss in broad terms what is currently known about various nutrition, health and educational problems (perhaps using **Table III and Table IV** as checklists). This joint exercise will not produce *exact* figures of prevalence, incidence or seriousness of different conditions and problems, but rather provide information about the magnitude of these problems (categorized in terms of **high, medium and low** prevalence) and about possible local links between these problems and educational consequences,i.e., whether intestinal parasites or iron-deficiency anemia are **major** or **minor** problems and whether or not they appear in geographical areas manifesting indicators of poor school attendance or early attrition. In some countries, a similar exercise at *provincial* or *district* level may be feasible and desirable.

Local/Community Level

As shown **Table I**, some nutrition and health assessments are *relatively simple, and low-cost,* and can be done by the classroom teachers themselves (or parents) with minimal training. Teachers, of course, will need time to undertake the diagnosis and will also need to be motivated enough to do it. An important part of teacher motivation or incentive will relate to the extent to which something can and will be done about the problems identified.

The next level of assessment described would need to be carried out by a mid-level health worker or laboratory technician at a lower level of training than a medical doctor or university-trained laboratory scientist.

TABLE I

Levels of Assessment of Nutrition and Health Factors

LEVEL I : CAN BE DONE BY PARENT/TEACHER OBSERVATIONS and/or EASILY TAUGHT TO SCHOOL TEACHERS:

short-term hunger
night blindness
food patterns
Grade II and Grade III goiters
ascaris, other parasites
(self-reporting/observation)
blood in urine--schisto, haematobium
(self-reporting, observation)
guinea worm (self-diagnosis)
malaria (presumptive diagnosis on basis of fever)
diarrhoea (self-reporting)
scabies (self-reporting/observation)
otitis media (self-reporting/observation)
respiratory infections
visual disabilities (teacher using eye chart)
gross hearing defects (whisper test)
physical disabilities
dental caries
pregnancy, injury, accidents

LEVEL II: REQUIRES A MID-LEVEL HEALTH WORKER OR LABORATORY PERSON (NON-UNIVERSITY TRAINED LABORATORY TECHNICIAN):

skinfold thickness
hemoglobin
Bitot's spots
dietary intakes
small goiters
stool exam for worm eggs
schisto eggs in urine or stool
guinea worm (clinical diagnosis)
malaria (blood slide)
scabies (clinical diagnosis)
otitis media (clinical diagnosis)
respiratory infections (clinical diagnosis)
hearing (audiometry)
dental caries (oral exam)

LEVEL III:REQUIRES A MEDICAL DOCTOR, HIGH-LEVEL HEALTH WORKER, TRAINED LABORATORY PROFESSIONAL:

xerophth. signs
serum retinol
urinary iodine and biochemical evaluation
sputum exam for T.B, etc.
chest X-rays
hearing (exact diagnosis)

The third and highest level of assessment requires a medical doctor or well-trained laboratory scientist (and in some instances, expensive equipment), and these tests may be of *higher* cost, and are sometimes *expensive*.

The next table presents three comparable levels of assessment of education factors; Level I includes information that classroom teachers can collect; Level II can be collected by certain teachers (or other community members) after special training; Level III requires professional assistance in data collection.

It should be noted that although intelligence tests (IQ tests) are described as "simple" to administer, they are quite difficult to interpret, particularly since the norms that are given are usually not relevant to the population that is being tested. From the point of view of information, intelligence or cognitive tests do not give any more information than an "achievement" test. It is therefore advisable to develop an instrument for the assessment of aptitudes, constructing standardized achievement tests that would serve both purposes---on the one hand a measure of aptitudes, and on the other, a measure of performance.

TABLE II

Levels for Assessment of Educational Factors

LEVEL I: DATA FROM ALL TEACHERS INCLUDING INFORMATION FROM PARENTS (may sometimes require training)

enrolment
attendance
repetition
drop-out
school performance

LEVEL II: DATA FROM CERTAIN TEACHERS OR FROM LOCAL HELPERS (PARENTS) AFTER SPECIAL TRAINING

reasons for absence
reasons for drop-out
cognitive processing (sometimes dependent on the system and training)
general achievement tests (simple)
standardized intelligence tests (simple)

LEVEL III:DATA FROM PROFESSIONALS (EDUCATION, PSYCHOLOGY, etc.)

analysis of enrolment, attendance, drop-out
causes of lack of enrolment, low attendance, high drop-out
cognitive processing
general achievement tests (complex)
standardized intelligence tests (complex)

2. NUMBERS FOR ASSESSMENT

For certain nutrition and health problems, each child needs to be diagnosed or assessed; for certain other conditions, a sub-sample of between 2 - 5% of *all children* or *all schools* may provide sufficient information to allow guidance for interventions and for evaluation. For example, vision problems that can be addressed by moving near-sighted children to the front of the classroom, require identification of all those children with near-sighted vision. It is important to identify those children with actual visual problems. Whereas, for other problems of significantly higher prevalence, and which would necessitate broad-based treatment of a large proportion of children in an affected area, as for example in cases of Vitamin A or iodine deficiency, only 2 - 5% of children or schools (2-5 schools out of every 100) would need to be assessed in order to guide interventions or evaluation.

It may also be necessary to assess the extent to which primary school teachers are absent from school, and if this absence is due to sickness and for what health reason (e.g., malaria); an absent and unreplaced teacher may deprive a large class of children of schooling altogether.

3. EVALUATION AND SURVEILLANCE

Seven nutrition and health problems are identified as having highest priority for intervention based on prevalence, ease of diagnosis, and feasibility of control or ease of treatment. These include:

* intestinal parasites and short-term hunger
* iron deficiency anemia
* protein-energy malnutrition
* Vitamin A deficiency
* visual impairment

A *package* of school-based interventions may be desirable, and cheaper than the additive costs of separate interventions (see guidelines on interventions). Also, interventions targeted at one problem may have an impact on another problem (i.e., de-worming may reduce the extent or severity of iron-deficiency anemia).

Under certain circumstances a ***nutrition/health chart*** kept for each child might be extremely useful as a guide for screening and assessing and as an educational device for parents. However, feasibility of such a chart must be determined in terms of time constraints imposed on classroom teachers and cost to the school system. The Departemen Kesehatan/Indonesia has developed a ***school health card*** for primary school children (see ANNEX) which is now being pre-tested on a large scale in the country.

A standardized ***nutrition and health chart, which is user friendly*** in design, could include information on: attendance, reasons for absenteeism, immunization status, annual (or more frequent) health and weight measurements, haemoglobin levels or presence of parasites, provision of anthelmenthics, iodine, Vitamin A, etc. Information collected would: (a) identify individual children; (b) generate aggregate data beyond the school-level, serving as a basis of analysis for identifying and designing school-based interventions; (c) provide an overall status of the nutrition/health conditions in schools, districts and the country in general; and (d) be used to assess secular changes over time.

TABLE III

PROBLEM	METHOD OF IDENTIFICATION; INDICATOR	PREVALENCE	EASE OF DIAGNOSIS	EDUCATIONAL CONSEQUENCE	EASE OF CONTROL
I. NUTRITION					
PE Maln.	Anthropometry	+++	+++	U or +	+ (complex; costly) because of need for high rations
Short-term hunger	Interviews, surveys	+++	++++	++++	+++ (less costly than above because smaller rations)
Iron Deficiency	Hemoglobin	++++	++	+++	++
Vitamin A Deficiency	Serum Retina Dietary Ex.	++ variable	+ +++	U	++++
Iodine Deficiency	Examination for Goitre	++ variable	+++	U (possibly high)	++++
II. INFECTIOUS DISEASES					
Intestinal Parasites	maternal observation Stool Examination	++++	+++ +	possibly high	++++ frequent, but cheap
Schistos. - Haem. - Mans.	Urine for ova or blood; Stool for ova	++	+++ +	U possibly high	++++
Guinea Worm	Easy Self-Diagnosis; Clinical Exam.	++ or + Variable	+++	++++	+++ public works
Malaria	Blood Slide	++++	++	++	+
Diarrhoea	Self-Diagnosis	+++	++++	++? U	+ (complex)
Respiratory Diseases	Self-Diagnosis Sputum	+++	++++ +	++ ? U	+ (complex)
Scabies	Self-Diagnosis	+++	++++ ++	++ ? U	++

TABLE III

PROBLEM	METHOD OF IDENTIFICATION; INDICATOR	PREVALENCE	EASE OF DIAGNOSIS	EDUCATIONAL CONSEQUENCE	EASE OF CONTROL
Otitis	Self-Diagnosis Clinical Examination	++	+++ ++	+++ if recurrent	++
III. DISABILITIES					
Low Eye Sight	Eye Charts	+ or ++	++++	+++	++++ (front of class) +++ (specs - costly)
Low Hearing	Audiometry	+	+	+++	++++ (front of class) ++ (hearing aids costly and technically difficult)
Physical Disability	Self-Evident	+	++++	variable	+
Pregnancy	Self-Teacher	+	++++	+++	+
Injuries, accident	Self-Teacher	+	++++	++++ (if it leads to disease)	++

+ = Very Low; Very Difficult
++ = Low; Somewhat Difficult
+++ = Moderately Prevalent; Relatively Easy
++++ = Highly Prevalent; Very Easy
U = Unknown

TABLE IV

PROBLEM	METHOD OF ASSESSMENT	COMMENTS
I. QUANTITATIVE		
Enrollment	School Records	Varies over the year; should be recorded by age and sex; gross-enrollment versus net-enrollment; attention: bias for higher returns
Attendance	School Records	Often available only on level of individual schools; record by age and sex; attention: bias for higher returns
Repetition	School Records	Varies locally (Indonesia: automatic promotion); by age and sex
Drop-Outs	School Records	By age and sex
II. QUALITATIVE		
SCHOOL PERFORMANCE	Local	Although grades are a very doubtful measure of school achievement, correlation between grades and poverty/malnutrition remains significant; only available on class-level
Language Mathematics	Grade System	
COGNITIVE PERFORMANCE (information processing)	Psychological Group Testing (Raven)	
GENERAL ACHIEVEMENT	Specially developed tests; applicable by teacher	Normally only at school-end; but could be adopted to/ designed for ad-hoc situations
ALERTNESS	Simple speed tests; can be applied by teacher	Not common, but feasible; if used as psychological tests, must be applied by psychologist

INTERVENTION

IDENTIFYING AND PLANNING INTERVENTIONS

INTRODUCTION

Interventions to address school nutrition and health problems can be : (1) classroom-based; (2) home-based; and/or (3) clinic-based. Available inputs include chemotherapy (e.g., anti-helminths), food (e.g., a school-feeding programme), classroom management (e.g., moving children with nearsighted vision problems to the front of the classroom), or nutrition education (aimed at promoting behavioural change). Each type of intervention requires probably 3 different sets of *training activities*: (1) training that reaches the education sector; (2) training that reaches the health sector; and (3) training that reaches community members, in particular, parents of primary school children. Similarly, for each intervention there are always two sets of *costs*: (1) direct costs; and (2) hidden costs or opportunity costs (the opportunity costs include reduction in classroom teaching time as teachers focus on other activities which in turn perhaps take away time that would be spent in direct instruction).

The Working Group on Interventions produced (1) a protocol to help planners design school nutrition and health interventions which will result in improved academic performance; (2) recommendations for the kinds of school nutrition and health services which a Ministry of Education can provide; (3) a discussion of resources and constraints related to intervention strategies in 5 priority nutrition/health problem areas which were developed in association with the Working Group on Assessment; and (4) recommendations for a *basket* of low-cost primary school nutrition and health technologies.

1. PROTOCOL FOR PLANNING SCHOOL NUTRITION AND HEALTH INTERVENTIONS TO IMPROVE PRIMARY SCHOOL PERFORMANCE

The following protocol should help project planners design effective school nutrition and health interventions. The protocol consists of a series of *tasks* that need to be carried out to: (1) define the nature of the nutrition, health and learning problems that affect the target population; and (2) assess the efficacy of various intervention strategies to address these problems.

(1) Define the target population, e.g., by age, sex, grade level.

(2) Define the nutrition and health problems that are most prevalent among the target primary school population(taking particular note of whether the problem is acute or chronic, or serious, moderate, mild).

(3) Identify the learning problems that are associated with the condition(s) described in TABLE I.

(4) Define the approach (select one or more of the following approaches and define the strategy that will be used for each):

- (a) medical intervention
- (b) nutrition intervention
- (c) classroom management intervention
- (d) nutrition education intervention

(5) Describe the location of the intervention (identify specific areas of coverage for each of the relevant options below):

- (a) school-based
- (b) home/community-based
- (c) clinic-based

(6) Analyze the approach---is it appropriate:

(a) medically/nutritionally
(b) culturally
(c) politically

(7) Has the approach been tried before?

Where?
What were the lessons learned?

(8) What are the proposed mechanisms for:

(a) monitoring and process evaluation of the proposed intervention, and

(b) impact evaluation of the intervention on academic performance.

Indicate relevant dependent and independent variables.

(9) Define the management structure:

(a) agency in-charge

(b) roles of collaborating ministries; and agencies at national and local levels

(c) roles, responsibilities and institutional affiliations of key personnel

(d) role of international support

(10) Enumerate project inputs:

(a) implementors (i.e., teachers, health workers)

(b) materials and supplies

(c) training requirements

(d) supervision requirements

(11) Estimate of costs:

(a) direct costs

* recurrent costs---medical, non-medical
* non-recurrent costs---medical, non-medical

(b) indirect costs

* opportunity costs

(12) Issues of absorptive capacity:

(a) Is the community knowledgeable about the problem and proposed intervention?

(b) Is the logistics and supply system adequate?

(c) Will the intervention place excessive demands on teachers' time?

(d) Is the intervention capable of generating self-sustaining benefits?

(e) Is there adequate coordination between the Ministry of Education and the Ministry of Health, or other collaborating ministries and/or agencies?

(13) Is the community actively involved? Does it have influence over the intervention? Does the intervention meet felt needs? Are there local resources?

(14) Is there a parent-teacher dialogue and cooperation?

(15) Expected outcomes:

(a) education

(b) nutrition

(c) health

(d) other

(16) Are there further questions for operations research?

2. RECOMMENDATIONS FOR THE MINISTRY OF EDUCATION IN SETTING UP A SCHOOL NUTRITION AND HEALTH SERVICE

Preferably, the Ministry of Education should have a ***School Nutrition and Health Unit*** which would be staffed with a nutrition and health professional either directly hired or seconded by the Ministry of Health.

In primary schools with several teachers, one teacher in each school should be trained in nutrition/health; in primary schools with few teachers, one teacher should be selected and trained to serve a group of schools.

Classroom teacher school nutrition/health functions could include screening, record keeping, parental out-reach, administration of basic medication, and nutrition education. Classroom teachers can learn simple *assessment techniques* such as:

	sign	problem
*	child loses weight	protein-energy malnutrition
*	iron-deficiency	paleness, apathy, sleepiness
*	Vitamin A	night-blindness
*	malaria	fever
*	respiratory infections	cough/running nose
*	schistosomiasis	child complains
*	scabies	scratching
*	hearing	whisper test

The Ministry of Education should support school nutrition and health services at the local level by arranging for the provision of *essential technology packages (see following illustration)*, teacher training (both pre-service and in-service), school supervision, and educational materials. Where possible, Ministry of Education and Ministry of Health personnel involved in school nutrition and health should be jointly trained.

Community school nutrition and health *boards* or *councils*, which involve both parents and teachers of primary school children, should guide the design and implementation of school nutrition and health programs at the local level.

3. RESOURCES AND CONSTRAINTS

The institutional and financial aspect of assessment activities are important to identify in order to be able to tap *local resources* for the implementation of interventions (e.g.,local labour to help improve the hygienic and safety environment of the school) and determine types of *constraints* to implementation. Resources and constraints for five priority conditions can be summarized as follows:

(1) INTESTINAL PARASITES

Deworming is relatively cheap; approximately US $0.25-0.40 per drug treatment; it is both a therapy and public health measure-it reduces contamination of the environment following deworming; and more, importantly, it improves the nutrition/health status of children, especially those with large worm burdens. Where hookworm infections are important, it will also reduce iron-deficiency anemia in the *easiest and cheapest* way, and where ascariasis or roundworm infections are prevalent, it will eliminate serious complications (it is estimated that 100,000 children die each year of intestinal obstruction and other abdominal complications due to ascariasis, whereas 8,000 people in the world died in 1987 of AIDS).

Deworming requires logistical arrangements (including transport, storage (though drugs have long shelf lives and are highly stable even in tropical conditions), distribution and recording. It involves a minimal training of teachers and other school staff; time of school personnel for administration and recording.

It should be noted that costs could be reduced if the drug is included in the country's Central Drug List and delivered to schools accordingly; this applies also to iron deficiency (see #3 below).

Deworming should always be combined with sanitation, clean water supply and health education activities which will contribute to the long-run reduction in infection due to contamination.

(2) SHORT-TERM HUNGER

Although it has been established that short-term hunger has an effect on cognitive function, further research is needed to understand the consequences of short-term hunger on educational performance. Further, the methodology for assessing short-term hunger still has shortcomings, thus prevalence figures are often guesstimate.

There are several types of approaches:

(a) community-organized feeding programmes:

These programmes should be responsive to local nutrition needs and local food resources and are desirable in that they avoid creating external dependency. Desirable in the long-term, they do, however, require personnel (teachers, parents), food, water, fuel, cooking facilities. They require community-commitment, teacher/parent/family motivation, and time. School/community gardens have been and are used as sources for food; school gardens themselves, however, are rarely successful if they depend on teachers and children alone for cultivation.

(b) externally-financed school feeding:

Though less demanding on local resources, and often a *cheap* alternative for schools compared to other administratively more demanding interventions, these programmes are more costly in terms of government counter-part contributions (i.e., transport, storage). Although there is the risk of creating dependency, this intervention approach can often be mounted and implemented sooner than community-based feeding activities.

(c) nutrition education:

Parents can be encouraged through nutrition education to provide nutritious foods to their children to bring to school or to provide resources for locally-based feeding programmes. Nutrition education designed to promote changes in eating behaviour (i.e., skipping breakfast) requires systematic development, starting with understanding of local knowledge, attitudes and practices relevant to specific behaviours. It should focus on student nutrition/health-related problems or on problems that students and/or parents exercise a locus of control over. Educating teachers, parents and school children can only be considered successful with desirable changes in nutrition-related behavior which may take time to achieve. Costs are not insignificant, but may be reduced if combined with other public health education/promotion actions.

(3) IRON DEFICIENCY

A first alternative should focus on control of intestinal parasites which will contribute to a reduction in *anemia* (see item #1 above); as a secondary alternative, iron

supplementation should be considered while recognizing constraints of cost, difficulty of diagnosis and possible toxicity; combined with drug therapy or alone, nutrition education can be another alternative only in mild deficiency conditions.

(4) IODINE

A relatively inexpensive supplement, US $0.12/per child/every two years; as a longer-term intervention, fortification may be preferable, depending on the food vehicle used and its delivery system in the country; a concern over toxicity is questionable

(5) PROTEIN-ENERGY MALNUTRITION

All problems and reservations on short-term hunger (item #2 above) could apply; in addition, costs are higher (food input is greater) and outcomes are less certain, because of higher complexity (i.e., compounding problems related to parasites, other diseases, general poverty). It is important to differentiate between:

* wasting (low weight for height)

* stunting(low height for age)

Benefits of supplementary feeding are probably more achievable in conditions of wasting rather than stunting; however, there may be a possible improvement, if appropriately timed, in female "growth spurt".

4. LOW-COST PRIMARY SCHOOL NUTRITION AND HEALTH TECHNOLOGY PACKAGES

The Working Group on Interventions was asked to identify low-cost technologies that could be utilized, primarily at the classroom level, to improve student nutrition and health status and academic performance. The Group recommended both a *short-term* and a *long-term* "technology basket" (see Figure 1). The *short-term* basket (which includes nutritional supplements, parasite control drugs, school feeding programmes and a first aid kit) consists of readily available technology inputs which can be put in place to address immediate needs. The Group felt, however, that countries also should develop *long-term* programmes to create the more profound changes in school and economic infrastructure needed to eradicate school nutrition and health problems. Hence, a *long-term* technology basket is also recommended consisting of programmes for environmental control, school food production, dietary change, and local manufacture of first aid kits.

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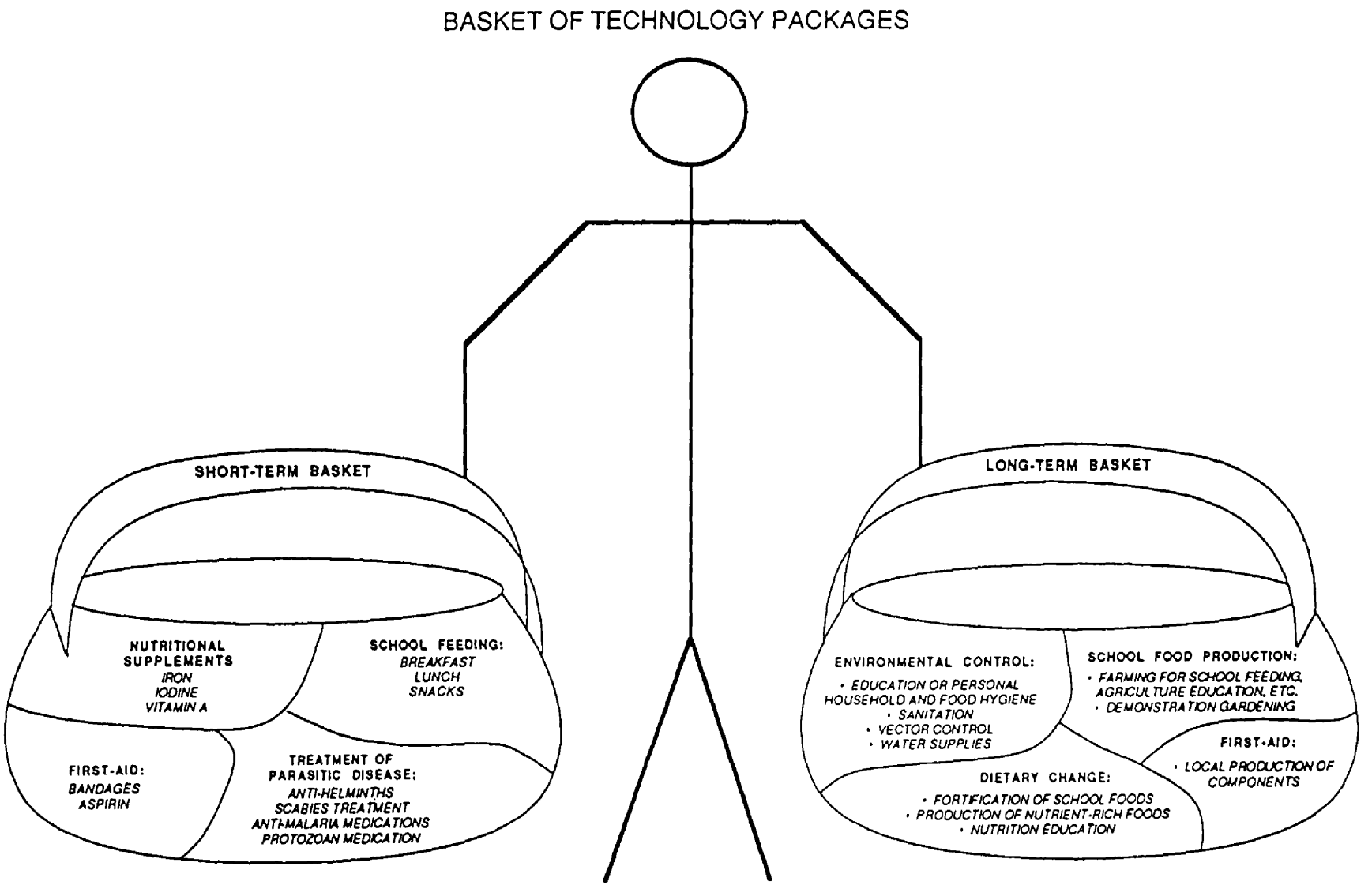
School-based nutrition and health interventions to improve primary school performance could have significant educational results. It should also be recognized that there will be additional benefits to improving the nutrition and health of school children. Better nutritional health status of school children will improve the *quality of life* and *well-being* of millions of human beings in their own right. School children who are healthy, have adequate energy and feel well, are likely to be happier, better adjusted, stronger, more productive and, in general, better human beings while they are in school. During their whole future, their lives may be richer and more rewarding for themselves, their communities and nations. For example, a serious ear infection in a child that goes undetected and untreated may lead to a permanent long-term hearing disability which will remain until that person dies; uncontrolled malaria might result in a child getting cerebral malaria which may leave the child (and the adult that he or she becomes) with permanent mental dysfunctioning.

Improving the nutrition and health of primary school children will have immediate benefits for families and their communities. Primary school children spend perhaps 15% of their time available to them each school year in the classroom, 35% of their time sleeping and around 50% on other activities. In the same way that good nutrition and health improves the *functioning, productivity and abilities* of adults, it will do the same for children who are often involved in other important activities, i.e., agriculture, animal husbandry, household chores including carrying water and fuel, food preparation and sibling child care.

FIGURE I


BASKET OF TECHNOLOGY PACKAGES
SHORT-TERM BASKET
NUTRITIONAL SUPPLEMENTS
IRON
IODINE
VITAMIN A
SCHOOL FEEDING:
BREAKFAST
LUNCH
SNACKS
FIRST-AID:
BANDAGES
ASPIRIN
TREATMENT OF PARASITIC DISEASE:
ANTI-HELMINTHS
SCABIES TREATMENT
ANTI-MALARIA MEDICATIONS
PROTOZOAN MEDICATION
LONG-TERM BASKET
ENVIRONMENTAL CONTROL:
• EDUCATION OR PERSONAL HOUSEHOLD AND FOOD HYGIENE
• SANITATION
• VECTOR CONTROL
• WATER SUPPLIES
SCHOOL FOOD PRODUCTION:
• FARMING FOR SCHOOL FEEDING, AGRICULTURE EDUCATION, ETC.
• DEMONSTRATION GARDENING
FIRST-AID:
• LOCAL PRODUCTION OF COMPONENTS
DIETARY CHANGE:
• FORTIFICATION OF SCHOOL FOODS
• PRODUCTION OF NUTRIENT-RICH FOODS
• NUTRITION EDUCATION

DIRECTIONS FOR OPERATIONS RESEARCH

OPERATIONS RESEARCH

INTRODUCTION

The existing scientific research and knowledge base more generally provides valuable, though incomplete, suggestions for promising interventions. Knowledge gaps do, however, exist and it remains important to identify the *main gaps* concerning probable intervention with particular attention to efficacy and cost and feasibility of these studies.

Different types of research are identified as feasible:

(1) Collation of available documentation on prevalence of morbidity and nutrient deficiencies in primary school children

(2) Descriptive/observational research to define the problem and key variables

(3) Experimental intervention to establish aetiology (in this case *cost would not be a priority when establishing causality* for the first time)

(4) Intervention evaluation which incorporates cost and problems of implementation

(5) Policy analysis which could include analytical literature reviews, country case studies, and hypothetical cost-effectiveness and cost-benefit studies

The present section focuses on the first three suggested types of research: prevalence analysis (using existing data), descriptive/observational research and experimental intervention research.

1. RECOMMENDATIONS FOR RESEARCH

Nutrition and health conditions thought to be important and likely to *affect school performance* include:

nutritional deficiencies	infections
hunger	trichuris
wasting	ascaris
stunting	hookworm
iron	schistosomiasis
iodine	giardia
Vitamin A	entamoeba/ histolytic
zinc	malaria
obesity	diarrhoea
	sleeping sickness
	leishmaniasis/ onchocerciasis
	vaccine preventable disease
	T.B., respiratory infections
	skin infections, scabies

other
sensory deficits
ear, eye
injury
war, household
toxicity
lead
aflatoxin
cyanide
congenital defects

Need for further research is identified as follows:

(a) Short-term hunger:	*Experimental intervention study* to establish affects on school performance; it is already established that short-term hunger has an effect on *cognitive function*.
(b) Wasting/stunting:	An association with protein-energy malnutrition and performance is well established; require an *observational study* of *association* with enrolment.
(c) Iron-deficiency:	There is no need for further research on *mild iron-deficiency without anemia*; we need an *experimental intervention study* of iron treatment in deficiency associated with anemia.
(d) Iodine:	It is established that *severe iodine deficiency* is associated with poor cognitive function in school children; we need an *experimental study* of iodine treatment with moderately deficient children.
(e) Vitamin A:	There is little, if any, information on the relationship between Vitamin A deficiency and non-enrolment, absenteeism, and poor performance; *observational studies* are needed.

(f) Zinc	There is some evidence that zinc affects development in animals and that it affects growth in children; there is no real evidence on the effect of zinc deficiency on development in children; as there are some existing epidemiological studies on zinc deficiency, it is desirable that *school measures* be incorporated into these studies.
(g) Trichuris and ascaris:	Very prevalent and peaks between 6 and 10 years of age, particularly common in urban areas; there is a clear association with growth; treatment through schools already demonstrated as feasible and reasonably *low-cost in some school systems*; need for *experimental intervention study*.
(h) Hookworm:	Peaks at older age than trichuriasis and ascariasis; some evidence of an effect on growth; need for an *experimental intervention study*.
(i) Schistosomiasis:	Less prevalent than the previous 2 diseases; some poor evidence of no effect on children's development; treatment more expensive than for gut helminths; need for more *experimental studies,* but not a priority.

(j) Diarrhoea:

Need for *observational study* to determine association with attendance; chronic diarrhoea needs to be studied particularly for prevalence and aetiology.

(k) Respiratory infections, TB, injury:

All need *observational studies* to determine relationship to enrolment and absenteeism.

(l) Malaria:

Important to distinguish malaria infection from malaria disease.

It is poorly documented how much malaria the disease affects school attendance, or school performance in the post-acute disease recovery phase when a child perhaps returns to school but still is not very well. There is no information at all on the effect of malaria, the infection, and school performance. It is also poorly documented how much malaria parasitemia independent of anemia affects performance. Studies suggest that there are 0.2 to 3 attacks per year in school-age children depending on the endemic situation. Peak morbidity ranges from 2 - 3 years to 14 years in different areas, primarily from *Falciparum* and *Vivax*.

Observational studies needed to document the role of malaria the disease in absenteeism in different endemic areas.

Experimental interventions are also needed using chemoprophylaxis or other prophylaxis because of the complexity of intervening in malaria infection in endemic areas. The WHO, CDC, and other organizations performing anti-malaria trials should be informed by Unesco of the criteria to include *school outcomes* in their studies.

NOTE: Injected iron and food supplements can possibly enhance helminth, TB brucellosis and malaria, although one study in school-children showed no enhancement of malaria. Studies using iron supplements should be aware of the possible increases in parasite loads. More studies on the interaction of malaria and iron are needed. Also, iron studies need to control in the analysis for the presence of malaria parasites.

(m) Sleeping sickness, onchocerciasis, letshmaniants:

No need for global research.

(n) Vaccine preventable diseases:

No need for research.

(o) Sensory defects:

Need for *prevalence studies* on hearing and vision defects. Some evidence that hearing defects affect between 5 and 10% of school children (Philippines); some may be attributed to the effect of otitis media on language and reading skills acquisition.

Need *longitudinal studies* to determine the relationship between otitis media and hearing, language, and reading difficulties.

(p) Scabies/dental caries:

No need for research; more information needed on prevalence.

(q) Dyslexia:

Not a high priority health and nutrition problem at this time.

(r) Injury/accidents:

Need *observational research* to determine the relationship to attendance.

(s) Lead:

Urgent need to look at the prevalence of high lead levels in urban areas in developing countries, e.g., Mexico City, Jakarta, Bangkok. Also there is a need to determine the relationship with school performance (this relationship may not be the same as in developed countries because there may be an interaction between lead levels and underlying malnutrition and other specific nutrient deficiencies).

NOTE: School outcome variables should be added to original studies on zinc deficiency, Vitamin A deficiency, malaria, and diarrhoea.

There may be an interaction between different nutrient deficiencies and infections.

2. SUGGESTED RESEARCH AREAS

Epidemiological Study of School Participation (non-enrolment and absenteeism) and Nutrition and Health Status

Effects of Short-Term Food Deprivation on Educational Outcome Measures

Treatment of Trichuriasis and Ascariasis and Educational Outcome Measures

Hookworm Infection and Educational Outcome Measures

Effects of Iodine Deficiency on Mental Development and School Achievement

Iron Deficiency Anemia and Educational Outcome Measures

Epidemiological Study of School Participation (non-enrolment and absenteeism) and Nutrition and Health Status

Main Question: To what extent are variations in school participation explained by nutrition and health variables?

Population: School-age children in selected countries (three or four) with high levels of *poor* school participation.

Measurements: (a) school participation:

(1) proportion of school-age children who are in school and not in school

(2) proportion of school-age children of a given age who are enrolled in a lower grade than expected for age

(3) proportion of students who miss school and percentage of total class days missed

(4) proportion of students at a given grade level who are *repeaters*

(5) proportion of students who have *dropped out* of school

(b) nutrition and health status:

(1) height for age, short-term hunger

(2) biochemical and clinical measures of Vitamin A deficiency

(3) parental reporting/recall of incidence of diarrhoea, respiratory disorder, TB, malaria

(4) tests of visual and auditory ability

(c) other relevant data:

Information on the probable reasons for *"poor"* school participation (for statistical control), e.g., accessibility, socio-economic factors, etc.

Collaborating Institutions: University of the Philippines; institutions in India and Guatemala

Effects of Short-Term Food Deprivation on Educational Outcomes

Main Questions: What are the effects of providing a school meal to primary school children on school achievement, attendance and classroom behavior? Are effects different in different age groups, e.g., 7-8 year old children? 10-11 year old children? Are effects different between undernourished and adequately nourished children? Does the time of food provision make a difference, e.g., breakfast or lunch?

Location: Schools in poor areas.

Measurements: Using a random assignment of nutrition and milk among a sample of 7-8 year olds (80 undernourished and 80 nourished) and a sample of 10-11 year olds (80 undernourished and 80 nourished), measures of:

(1) attendance
(2) reading, spelling, arithmetic
(3) height
(4) weight
(5) classroom behaviour

Collaborating Institutions: Tropical Metabolism and Research Unit, University of the West Indies, Kingston, Jamaica

Duration: 24 months

Treatment of Trichuriasis and Ascariasis and Educational Outcome Measures

Main Question: How to determine the short and long-term consequences of anthelmintic treatment on cognition and educational outcomes among school-age children with different intensities of helminth infections?

Location: Countries with a high prevalence of trichuriasis and ascariasis, i.e., in the Caribbean, or Kenya or Malaysia.

Population: A sample of school-age children:

short-term: one age, one sex (N=50)
Ascaris epg> 10,000
Trichuris epg> 5,000

long-term: 120 children x group n
(6 - 9 years/per group)

Infection criteria for selection of children:

high: (>10,000 Asc; >5,000 Tri)

medium: (<1,000- 10,000 Asc;
<500-5,000 Tri)

low: (<1,000 Asc; <500 Tri)

Measurements: (1) Blind, randomized, placebo and anthelmintic (albendazole or mebendazole in multiple doses). Test and retest of information processes before and 8 days after treatment. Confirmation of treatment efficacy.

(2) Blind, randomized, placebo and anthelmintic (single dose) at 4 month intervals of 12 months in schools. Assessment of school achievement measures. Assessment measures before each treatment. Monitoring of attendance. Confirmation of treatment efficacy.

Collaborating Institutions: Tropical Metabolism and Research Unit, University of the West Indies, Kingston, Jamaica; University of Malaya, Kuala Lumpur, Malaysia; Imperial College Field Centres in Saint Lucia and Dominica; Unicef/Florence.

Duration; 24 months

Hookworm Infection and Educational Outcome Measures

Main Question:	How to determine the short and long-term consequences of anthelminthic treatment on cognition and educational outcomes among school-age children with differing intensities of hookworm infections?
Location:	Zimbabwe, Malaysia
Population:	Sample of school-age children
	short-term: one age, one sex
	long-term: 120 children x group
	Infection criteria for selection of children:
	high: >2,000 epg
	medium: >500-2,000 epg
	low: <500 epg
Measurements:	Treatment at six month intervals for 18 months.
Collaborating Institutions:	Blair Laboratories, Harare, Zimbabwe, University of Malaya, Kuala Lumpur, Malaysia
Duration:	24 months

Effects of Iodine Deficiency on Mental Development and School Achievement

Main Question: Does the administration of iodine have positive effects on the mental development and school achievement of children from severely iodine-deficient areas?

Location: Primary schools in iodine deficient areas.

Population: First grade primary school children (300 from different schools), selection of schools by available medical facilities.

Measurements: The group of 300 children (150 treated with iodized oil, 150 given a placebo) will be studied 3 times, at intervals of one year with the following measures:

(1) physiological measurements: goitre rate, % of cretinism, TSH, T4, UIE, weight, height, socio-economic status

(2) psychological and educational measurements: enrolment, absenteeism, retention, drop-out, school achievement, concentration/perception, ability

Collaborating Institutions: Faculty of Medicine, Universitas Dioponegdro, Semarang, Indonesia; Faculty of Psychology, Universitas Indonesia, Jakarta; Faculties of Medicine and Psychology, Universidad Autonoma, Madrid, Spain; Faculty of Psychology, Free University, Amsterdam, the Netherlands.

Duration: 36 months

Iron Deficiency Anemia and Educational Outcome Measures

Main Question: Iron deficiency anemia affects *time-on-task, perseverance and school achievement* among pre-adolescent children; does iron repletion therapy and maintenance of an iron-replete state over a two-year period result in full academic rehabilitation?

Location: In a region where the prevalence of iron-deficiency anemia is greater than 10% and in schools where interventions can be conducted with the collaboration of the education sector.

Measurements: Randomized, double-blind clinical trial (Rx/Pl) with Fe dosage appropriate for weight and age with randomization of treatment without knowledge of the iron-status of children (de-worming treatment prior to baseline evaluation). Randomized, double-blind pre-test; prescription with dosage calculation.

(1) Fe, Hb, ferritin, transferrin saturation, free erythrocyte protoporphyrin, Pb, Vitamin A

(2) Educational outcome measures: time-on-task (maintenance of attention); perseverance (to be determined); school achievement (standardized tests)

Collaborating Institutions: Nutrition Research Institute, Bogor, Indonesia; Nutrition Institute, Mahidol University, Bangkok, Thailand; University of Baroda, Baroda, India; National Nutrition Institute, Hyderabad, India; Institute of Nutrition of Central America and Panama, Guatemala.

Duration: 36 months

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A N N E X

First Technical Meeting

of the

New Unesco Project to Increase Primary School Performance

Through Improved Nutrition and Health

Wenner-Gren Center Foundation

Stockholm, Sweden

3-5 April 1989

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