GUIDE FOR PROMOTING WATER QUALITY IN SCHOOLS IN DEVELOPING COUNTRIES

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Guide for Promoting Water Quality in Schools in Developing Countries
Professionals in the fields of health and the environment have for some time regarded drinking water quality as a key element in people’s development because of its great influence on the health of the population. It goes without saying that deficiencies in drinking water quality are directly associated with gastrointestinal diseases, one of the leading causes of morbidity in developing countries.

Although the water-health link has given rise to interest and concern among the authorities of developing countries, there can be no doubt that there is very little knowledge or understanding of that link in the population at large. This is partly why the modification of cultural patterns with regard to safe water is still an incipient task.

From the results of projects carried out in the Region of the Americas, the Pan American Health Organization, through its Pan American Center for Sanitary Engineering and Environmental Sciences —CEPIS— has found that water quality promotion and management activities in student populations is an appropriate strategy to help change the mentality both of the school children and of their families.

This document is a simple guide containing the information indispensable for orienting educators and other school staff. It presents a simple methodology, already proven effective, to carry out with a bare minimum of funds a project that includes an evaluation of the school population’s knowledge of water quality, a survey of water quality in the school and in the children’s homes, a water quality surveillance program, and the correction of any anomalies and deterioration detected in the school’s drinking water system.

The practical benefits that have resulted from using this Guide have suggested to CEPIS the need to publish it for use in other countries that need this type of tool in an area that calls for priority attention.
The work of Felipe Solsona, specialist in water quality control, and of Consuelo Fuertes, social assistance worker and educator of ample recognized experience, will serve the ministries of health and education in each of the countries concerned and will be helpful to each school teacher and educator individually. The guide will enable teachers to improve their students' understanding of the need for concern about the quality of the water we drink, and the need for us all to take care of a resource (fresh water) that is becoming increasingly scarce and contaminated.

Dr. Mauricio Pardón
CEPIS Director
Chapter 1

water and health

Answering the questions of the survey
The impact of water quality on health

Water is closely linked with human life, because of its direct usefulness to human beings and because it is an essential element in the conservation of the ecosystem. It is also a basic agent of health or sickness.

Access to safe water is fundamental for people’s health. Contaminated water becomes one of the main vehicles for the transmission of diseases, which affect the most vulnerable sectors of the population, especially children.

Waterborne diseases, in particular diarrhea, are among the principal causes of morbidity and mortality in most developing countries. Children can catch these diseases by drinking contaminated water, because the microorganisms that cause diarrheal diseases are taken in with the water.

Among the main causes of diarrhea are the inappropriate disposal of excreta, inadequate hygiene, and the poor quality of drinking water. It is true that these causes are embedded in the situation of poverty, but they are also due to the lack of education and to inappropriate cultural patterns.

It is equally important to note the magnitude and weight of this situation in the quality of life of each individual and in the economy of mankind as a whole.

Diseases associated with contaminated water

Water-related diseases can be caused by bacteria, viruses, and parasites.
Diseases produced by bacteria are:

- Typhoid and paratyphoid, whose agents are Salmonella typhi, and Salmonella paratyphi A and B.
- Dysentery, whose pathogenic or causing agent is Shigella spp.
- Cholera, whose agent is Vibrio cholerae.
- Acute gastroenteritis and diarrheas, whose agents are enterotoxic Echerichia coli, Campylobacter, Yersinia enterocolitica, Salmonella spp, and Shigella spp.

The principal diseases of viral origin are:

- Hepatitis A and B, whose agents are the hepatitis A and B viruses.
- Poliomyelitis, whose agent is the poliomyelitis virus.
- Acute gastroenteritis and diarrheas caused by the Norwalk virus, rotavirus, enterovirus, adenovirus, etc.

The principal diseases of parasitic origin are:

- Amoebic dysentery, whose agent is Entamoeba histolytica.
- Gastroenteritis, whose agents are Giardia lamblia and Cryptosporidium (often found in homes where domestic animals are kept inside the house).

The route of fecal-oral contamination

Contamination, in any of its forms, is bad and unacceptable, but from the health point of view, it is the contamination of water by excreta that causes the worst problems.

This diagram shows the route of fecal-oral contamination.
The inappropriate elimination of human excreta contaminates the water, hands, and food, and through these three media microorganisms enter the mouth and cause disease and even death.

This situation arises because of poor habits of hygiene, the absence of sanitary education, and the consumption of bad quality water.

Water becomes contaminated because of the bad habits of the population and the little or no care they take of this most valuable of natural resources.

Waterborne diseases and their impact on children

Why are waterborne diseases more dangerous for children?

Diarrheal diseases in general and diseases of the intestinal tract in particular are especially dangerous for children because they affect their nutritional condition and consequently their capacity for normal growth and development, and in addition reduce their defenses against more complex diseases.

In an episode of diarrhea, a great deal of fluid and mineral salts are lost, and if the diarrhea is prolonged, dehydration is the result. This can quickly lead to serious debilitation and even death. If a child with diarrhea does not eat, which is usually the case, the child is also exposed to undernutrition, since important nutrients are eliminated from his/her body.
Children who get diarrhea often are not only more likely to become undernourished, but also more prone to a reduction in their learning ability. This is why educational activities aimed at improving children’s conduct with regard to hygiene and the consumption of safe water are vital if we are to prevent these diseases and contribute to the normal growth and development of the school children.

Generally speaking, children who live in poverty and in places where there is neither safe water nor sanitation are at greater risk of getting diarrheal diseases. However, it must be remembered that the mere presence of water and sanitation services, without good habits of hygiene, does not guarantee optimal conditions for keeping healthy. Habits of hygiene are the indispensable complement if these diseases are to be prevented.
Chapter 2  

water quality

Drinking water in some rural schools
Standards to guarantee water quality

From an institutional point of view, ensuring that drinking water is free of microbiological risks is the responsibility of the sanitary authorities. Each country should therefore set in place a referential framework to evaluate whether the water is safe to drink, or whether it is contaminated. This framework is called the drinking water quality standard (DWQS).

"By definition, a standard is a rule or principle that the authorities regard, by consensus, as a basis for comparison. It is something normal or average in terms of quality, and the most common form of its kind. A good standard for drinking water quality (DWQS) is a reference guaranteeing that the water will not be harmful to human health". ¹

On the one hand, a DWQS is a referential framework that makes it known what the water should be like in order not to pose any risk to those who drink it and, on the other hand, it is an instrument that obliges drinking water companies to supply water of good quality. The standard enables the health authorities to verify that quality and at the same time to have the necessary control mechanisms to correct any deficiencies detected.

Although everything is important in a DWQS, the most useful part from the consumers' point of view is the "table of parameters and concentrations", which lists the substances that can contaminate the water. The standard establishes the maximum permissible levels for those substances. Those levels are what are known as the "limits", and institutions

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monitoring water quality compare the results of the analysis of a specific water sample with the value of these limits to see whether the substances are below the limits or have exceeded them.

**Substances that contaminate water**

The substances present in water can be classified according to their chemical, physical, or microbiological characteristics, or other characteristics relating to their use, function, or physical condition.

The classification recommended by the World Health Organization (WHO) for contaminants is as follows:

- Microbiological contaminants
- Chemical contaminants (health-related)
  - inorganic
  - organic (excluding pesticides)
  - pesticides
  - disinfectants and disinfectant by-products
- Organoleptic contaminants.

The first group of microbiological contaminants includes protozoa, parasites, bacteria, viruses and other beings invisible to the human eye (some can be seen through a microscope, and others only through very special microscopes). These contaminants have an enormous impact on public health, because they are the main culprits in cases of diarrhea.

The WHO publishes an annual "World Health Report", whose epidemiological statistics show that diarrheas have the highest morbidity rates for the human species. In other words, diarrhea is the leading cause of sickness in human beings.

Since there are so many microorganisms that could be present in the water, when we want to know whether microbial contamination exists we cannot test for all of these microorganisms. Therefore certain
“indicator” microbiological organisms have been selected, and when a sample of water is tested, the presence of these indicators only is investigated. In the case of bacteria, the two most frequently used indicators are total coliforms and fecal coliforms. The presence of the former indicates generic contamination, while the latter means that the water is contaminated with excreta.

Water can contain a large variety of dissolved inorganic chemical substances. However, those of the greatest significance or which affect human health to the highest degree are fluorides, arsenic, nitrates, lead, mercury, barium, and chromium. When these substances are in the drinking water, they can cause serious diseases, even when exposure has been for a short time.

There is a long list of organic chemical substances of significance for health, and the same is true of pesticides and disinfectants. These substances can cause dangerous diseases such as cancer and malformations, although for this to occur the consumption of water containing these products would have take place over a long period (many years).

Organoleptic substances change the characteristics of water perceived by the senses, such as taste, smell, and color, but do not pose a serious health risk.

If we were to list the substances that contaminate drinking water in order of the risk they pose to human health (without taking into account their concentration), the chart would be as follows, from the most to the least hazardous:

<table>
<thead>
<tr>
<th>Group of substances</th>
<th>Health risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbiological</td>
<td>Very high</td>
</tr>
<tr>
<td>Inorganic</td>
<td>High</td>
</tr>
<tr>
<td>Organic</td>
<td>Low</td>
</tr>
<tr>
<td>Organoleptic</td>
<td>Very low</td>
</tr>
</tbody>
</table>
How does water get contaminated?

Water becomes contaminated when contaminating waste or materials are thrown into water sources. It may be a factory which discharges the wastes from its chemical processes into the river; or a farmer who uses toxic pesticides or herbicides; it may be a person who throws garbage into a river or lake; or one of us at home when we flush paint, oil, or poisonous substances down the toilet.

In other words, from large companies, to farmers, miners, and each one of us, everyone is responsible for contamination to a certain extent. And although it is true that some cause more contamination than others, we are all potential contaminators. This means that the care and protection of water quality is the responsibility of us all.

From the health point of view, as shown in the table above, the most significant kind of contamination is microbiological, and the sources of that contamination are those that need to be given the closest attention.

Quality of the service

Investigating the maximum values of contaminants present in water in a determined area is a way to verify its quality and decide whether it is good or bad, safe or unsafe. But it is important to take a step beyond this and find out what the possibilities are that the water could have an acceptable quality when tested and yet become unsafe a few days, or hours, later. In other words, the potential contamination risk also needs to be analyzed.

This means that not only must the intrinsic quality of the water be assessed, but also the quality of the service, that is, the water and the elements used to contain it, conduct it, store it, and deliver it to the consumers.

In addition to the quality values, a good service should meet the following requisites, known as “the requisites of the seven Cs and Qs”: 
<table>
<thead>
<tr>
<th><strong>Quality:</strong> the water must be free of elements that could contaminate it, to ensure that it will not become a vehicle for the transmission of diseases.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coverage:</strong> the water must reach all individuals without restrictions, that is, nobody should be excluded from access to good quality water.</td>
</tr>
<tr>
<td><strong>Quantity:</strong> people must have access to sufficient water for their personal use, for domestic use, and other uses according to each one’s needs.</td>
</tr>
<tr>
<td><strong>Continuity:</strong> the water service should be continuous and permanent, because if water is supplied for hours at a time the distribution system is more liable to become contaminated.</td>
</tr>
<tr>
<td><strong>Condition:</strong> this refers to the condition of the installations that conduct the water to the school and its place of storage—how safe they are from contamination, how clean they are, especially the tanks and deposits, and the general physical condition, including leaks, breaks, losses, etc.</td>
</tr>
<tr>
<td><strong>Cost:</strong> in addition to its natural value, safe water has a cost that needs to be covered by the consumers to pay for the materials used to purify it, the value of the installations, and their maintenance and repair. The cost should be reasonable: it should be sufficient to cover the treatment costs, but at the same time be affordable for the consumers.</td>
</tr>
<tr>
<td><strong>Culture of water:</strong> realizing the value of water and its link with health, people must make rational use of it, preserve it to prevent contamination, and take sanitary measures to ensure safe consumption for future generations. People who have the culture of water recognize the cost of producing clean drinking water and they are willing to pay that cost.</td>
</tr>
</tbody>
</table>
Guide for Promoting Water Quality in Schools in Developing Countries
CHAPTER 3

WATER IN SCHOOLS

Drinking water and latrines: habits, hygiene, health
Among people’s rights, the right to clean drinking water is a fundamental condition for health and an acceptable life quality. Boys and girls must have access to safe water from their earliest childhood, and they must understand the relationship between water, health, and development. This understanding will then translate into behavior that shows appreciation of water and its rational use for the benefit of present and future generations.

The school and the home are the most important places of learning for children. Hence the relevance of creating good habits with regard to water in the home and at school.

Water quality in schools is of vital importance for two reasons:

1. Because good quality water or safe water enables a child to be healthy, preventing diseases that could reduce the child’s normal learning skills, growth and development.

2. Because once the children understand and incorporate the “safe water” concept, they will be able to put what they have learned into practice and show good habits of hygiene, which will then be replicated in their homes and the community, so that they will become promoters of health and healthy habits for life quality.

The physical conditions of the sanitary installations in schools can either ensure or limit the practice of sanitary conduct on the part of the
school children and teachers, and this situation will influence the homes and the rest of the community.

The evaluation of the sanitary conditions of the school's water system and the investigation into the water quality should be carried out by the school staff and the children in joint activities that will become a routine. An important point of this concept is that the evaluation of the installations and the control of the water quality, involving simple sanitary inspections and the results of a couple of tests, are not the exclusive tasks of a health institution, a government agency, or the water companies, but rather any citizen (a student or a teacher) can carry them out as long as he/she has some basic knowledge and equipment, simple and cheap to use.

"Every individual or consumer has the right to perform drinking water quality control". This is the concept to be inculcated into the students so that they will have the initiative to investigate the quality of the water they drink. They will do this first in their school context, and later at home, where they can make the necessary verifications and take corrective steps to remedy any risk situations they may detect.

Adding this concept to the two points labeled reasons 1 and 2 above, gives the basis of the culture of water, which is precisely what the project seeks to develop in the school universe.

Physical conditions of water quality in schools

In chapter one it was seen that drinking water is closely linked with health, and many experiences have shown that the supply of safe water from the microbiological point of view can significantly reduce, directly or indirectly, mortality and morbidity due to diarrheal diseases, especially when accompanied by sanitary education imparted to the general population.

In schools in the poorest areas of some developing countries, the water and sanitation services are deficient, the water supply is not permanent, or water is supplied by water tankers, making it necessary to store it in tanks or drums. Such systems do not ensure water quality, so it can be risky to drink this water and besides, they do not enable the school
children to practice good habits of hygiene. Under such conditions the school population is at permanent risk of catching diseases.

In many schools in developing countries the water installations are in a very bad state of repair, conducive to contamination, which can lead to the school children drinking poor quality water. Many school authorities are unaware of this situation, and, owing to their ignorance or indolence, simple defects that could easily be put right continue to pose a risk to the children’s health.

Sanitary conduct oriented to forming the culture of water can be effective only if the basic conditions for putting good habits into practice are already in place, and if the school’s installations and practices permit such conduct.

There can be no question that water means health, better development, and an acceptable quality of life. A school that provides completely safe drinking water will be contributing to the physical and intellectual development of its students, just as much as a dedicated teacher who imparts the fundamentals of mathematics and grammar.

The cost of solving certain problems need not be an insurmountable barrier. There have been numerous experiences in the use of appropriate, low-cost technologies to improve water installations. Schools may coordinate with the pertinent health institutions for information in this respect.

? The quality of water as a sanitary concept in schools

It is the responsibility of the education authorities to introduce educational contents on water quality into school curricula at the preschool, primary, and high school levels, and the scope and depth of these topics will depend on the relevant political decisions. However, regardless of these policies, there should be minimal elements of awareness-building and activity in schools for analyzing and developing activities to reinforce concepts, habits, and attitudes referring to water quality.
The end result will be the development of habits of hygiene so that the children can be sure of better health and life quality. As in the case of other children’s and adolescents’ rights, the right to safe water is a component that will contribute to their personal formation and the development of life skills.

**The culture of water**

The culture of water forms part of the informing, awareness-raising, and attitude-building to take place in the student community. This culture will make simple but specific activities feasible involving cultural patterns aiming at ensuring safe water. This can be shown in diagram form:
The water and sanitation service in schools can be more efficient—and indeed most probably will be so in the majority of the poorest areas of the third world—if the points discussed in this document are taken into account. However, the engine moving all the efforts will be the firm desire to achieve the clean water goal; and this desire, regardless of more or less stringent government policies enforced by the ministry of education and already established in school curricula, must motivate each person responsible and each school teacher to take action in each of the schools.

Luckily, there is an abundance of information at all levels on the importance of water in human life and activity, as well as in the environment. The ministries of health and the environment and related institutions have materials available for instruction, dissemination, and awareness-building on the topic of drinking water.

In addition, ample experience already exists in the use of appropriate low-cost technologies to improve water installations, and information in this regard can be accessed through coordination with the pertinent health institutions, with engineers or builders or even with plumbers connected with the school.

? Full participation at school

The activities proposed in this project mainly target the school children. However, any program developed will also influence the school teachers and authorities: it has been confirmed that in the majority of cases there is marked ignorance on their part regarding the significance of water quality and related issues.

It is therefore practically an imperative to develop a program for improving water quality in schools, and this will mean supplying water of good quality and in sufficient quantity to ensure the health of the school children and the normal functioning of the sanitary installations.

A program of this type calls for minimal methodology and knowledge to improve the water service in the school, which in its simplest form is translated into a mechanism for carrying out sanitary inspections, cleaning the installations, and introducing methods for disinfecting the water, at the least.
The following project is proposed for promoting water quality in schools.
Chapter 4

CARRYING OUT THE PROJECT IN THE SCHOOL

Defective installations that need improvement
The project is a simple one, which can be carried out at very little expense, and it is not time-consuming. The project has four steps or activities:

- **Conducting the first survey:** this will reveal what the school children know about the quality of drinking water. The few questions are easy to answer and assess, and the answers will give a clear picture of the situation.

- **Activities for evaluating the water quality and quality of the service:** the activities will take into account the “seven Cs and Qs”. The school children should be informed about the evaluations to be performed and why they are being done. The way these activities are carried out will depend on the type of school, its characteristics, the number of students, and how it has been decided to organize them. One method that gives good results is to form small committees of 8-10 school children. Each of these committees will be led by a teacher, and will perform the evaluation by means of simple sanitary inspections. The results can be shared among the different groups. Selected delegates will inform the rest of the students in each class.

- **Activities to control the water quality:** this means making an effort to remedy anything found to be deficient or problematic in the previous step, and which could mean that the children are drinking contaminated water. If defective installations have been detected, the attempt will be made to correct them. If dirt or lack of cleanliness has been identified, the dirty elements will be cleaned. If the water does not contain chlorine
residual, a simple, economic, effective disinfection system will be implemented in the school facilities.

Campaign and fresh application of the survey: the fourth stage is a kind of small prior campaign of information and education regarding the importance of water quality. It can be as detailed or as cursory as required, and will make use of the resources available. This campaign is, without any doubt, the best opportunity for building awareness in the school community. Once the campaign is over, the survey will be repeated with a form that may or may not have some modifications with respect to the form used in the first step. The results of this survey will be compared with those of the first one to see how much progress has been made in promoting the importance of water quality.

Step 1:
The first survey

This is a simple survey with ten questions, to be applied to the children in the participating school. Although extremely simple, the filling out of a form and the activities the project calls for are activities recommended for children from third or fourth year of primary school upward.

The school teachers will decide whether any of the terms of the survey—and even any of the questions—need to be modified to bring them into line with local culture. In this reference it should be emphasized that this document is merely a "guide" and the flexibility this term implies should be taken advantage of.

Although it is a short survey, the results will give a clear picture of the school children's ideas about water quality, clean water, and the link between water and their health.

Based on the results, and regardless of how much or how little the children know about the water-health relationship, the exercise will be taken as a justification for preparing a project on "Water Quality in the School". The following form is proposed for the survey.
### SURVEY FORM

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water and diseases</strong></td>
<td></td>
</tr>
<tr>
<td>1. Can the water you drink make you get sick?</td>
<td>☒ YES ☐ NO</td>
</tr>
<tr>
<td>2. Mark the diseases that might be related to the water you drink</td>
<td>☒ Skin rash ☒ Headache ☒ Diarrhea (colitis) ☒ Cough ☒ Earache</td>
</tr>
<tr>
<td>3. If the water could make you sick, do you think there is some way to make it better (treat it) so that it won’t be bad for you?</td>
<td>☒ YES ☐ NO</td>
</tr>
<tr>
<td><strong>Water quality</strong></td>
<td></td>
</tr>
<tr>
<td>4. Could very clear water have something dissolved in it that we can’t see?</td>
<td>☒ YES ☐ NO</td>
</tr>
<tr>
<td>5. What is a microorganism? Which of the following do you think are microorganisms?</td>
<td>✗ A parasite ✗ A bacteria ✗ A bug ✗ A small fly ✗ A virus ✗ A small leaf</td>
</tr>
<tr>
<td>6. Mark one or more of these methods that you think help to discover whether the water is good for drinking and cooking:</td>
<td>✗ See how the light passes through the water ✗ Have a sample of the water tested in a laboratory ✗ See whether the water is cloudy or clear ✗ Test the water for chlorine</td>
</tr>
<tr>
<td>7. Mark one or more of the following that you think is a method for disinfecting water:</td>
<td>✗ Add chlorine or bleach to the water ✗ Leave it all night long in a bottle or bucket ✗ Soak a lettuce leaf in the water ✗ Put the water in a bucket and put two clean stones in it ✗ Boil it for three minutes ✗ Leave it all day in a transparent bottle in the sunshine</td>
</tr>
</tbody>
</table>
8. Do you know where the water comes from that you take from the tap, and once it is in the school, how it gets to your tap?
   - YES
   - NO

9. The pipes, tanks, and taps the water flows through in the school must be clean because:
   - Hygiene means having everything clean
   - The water can get dirty or contaminated
   - It is a school rule
   - It is the school caretaker's duty

10. Do you know whether the school's water installations are clean and in good working order?
    - YES
    - NO

**TOTAL SCORE**

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**NOTE:**

Before conducting the survey, the teacher can give a brief introduction or talk to the students about the need to know “what happens with the water we drink”, but without supplying information or making reference, at that time, about what drinking water means for health or about the need for water quality to be monitored.

Once the survey has been completed, which should not take more than a few minutes, the teachers collect the forms and mark them, giving one point for each correct answer. An answer is correct only when all the points in that question have been answered correctly.

The following page shows a questionnaire with 100% of the answers correct.
1. Can the water you drink make you get sick?
   - YES
   - NO

2. Mark the diseases that might be related to the water you drink
   - Skin rash
   - Headache
   - Diarrhea (colitis)
   - Cough
   - Earache

3. If the water could make you sick, do you think there is some way to make it better (treat it) so that it won’t be bad for you?
   - YES
   - NO

4. Could very clear water have something dissolved in it that we can’t see?
   - YES
   - NO

5. What is a microorganism? Which of the following do you think are microorganisms?
   - A parasite
   - A bacteria
   - A bug
   - A small fly
   - A virus
   - A small leaf

6. Mark one or more of these methods that you think help to discover whether the water is good for drinking and cooking:
   - See how the light passes through the water
   - Have a sample of the water tested in a laboratory
   - See whether the water is cloudy or clear
   - Test the water for chlorine

7. Mark one or more of the following that you think is a method for disinfecting water:
   - Add chlorine or bleach to the water
   - Leave it all night long in a bottle or bucket
   - Soak a lettuce leaf in the water
   - Put the water in a bucket and put two clean stones in it
### Water installations

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Do you know where the water comes from that you take from the tap, and once it is in the school, how it gets to your tap?</td>
<td></td>
<td>1</td>
</tr>
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<td>9. The pipes, tanks, and taps the water flows through in the school must be clean because:</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>- Hygiene means having everything clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The water can get dirty or contaminated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- It is a school rule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- It is the school caretaker's duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Do you know whether the school's water installations are clean and in good working order?</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>- YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- NO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SCORE**

<table>
<thead>
<tr>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

**Step 2: Evaluation of water quality and the water service**

This exercise of evaluating the quality of the water and of the water service should be done by all the grades in the school. Little effort is required, practically no funds or other resources, and it does not take much time. Each grade (each school) will be organized in the way best suited to the number of students, their characteristics, and similar activities carried out previously.

The whole class can do this exercise together, or a group of selected children or children who have volunteered, and who will afterwards inform the rest of the class of the details. The children who did not participate directly in the activities should in any case be aware of what was going on.

A leader should be identified (preferably a teacher or teacher's assistant) and a rapporteur or group of rapporteurs (students) to report to the rest of the class (if the whole class did not take part in the activities).
It should be recalled that the purpose of the exercise is to find out the quality of the water drunk by the school population, but at the same time it seeks to verify other conditions directly related to that quality and the "seven Cs and Qs".

The following chart presents the concepts (previously mentioned) of the “seven Cs and Qs”.

<table>
<thead>
<tr>
<th>Requisite</th>
<th>What it means</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quality</td>
<td>Determine the water's capability of preventing people's health from being affected.</td>
</tr>
<tr>
<td>2. Coverage</td>
<td>Find out how many people have access to piped water of good quality.</td>
</tr>
<tr>
<td>3. Quantity</td>
<td>Measure how many liters of water each person receives (at school or at home).</td>
</tr>
<tr>
<td>4. Continuity</td>
<td>Check that water is available all the time or find out the number of hours with and without the water supply.</td>
</tr>
<tr>
<td>5. Condition</td>
<td>Find out the condition of the water installations in the school, in terms of working order, hygiene, and safety (non-contamination).</td>
</tr>
<tr>
<td>6. Cost</td>
<td>Find out the cost of the water piped in to the school or the home.</td>
</tr>
<tr>
<td>7. Culture</td>
<td>Analyze how the population responds to the need to take care of water as a resource and maintain and monitor quality to safeguard their health.</td>
</tr>
</tbody>
</table>

The following chart summarizes the activities linked to each of the “seven Cs and Qs”, for study or evaluation purposes:
<table>
<thead>
<tr>
<th>Requisite</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Evaluate the water quality by analysis of chlorine residual, using simple chlorine comparators. If it is not piped water or is not chlorinated, ask the health authorities or the local water company for a bacteriological test.</td>
</tr>
<tr>
<td>Coverage</td>
<td>This information can be taken directly from the number of students covered, or the analysis may be extended to include their homes. Do they have piped water at home?</td>
</tr>
<tr>
<td>Quantity</td>
<td>Measure the volume of water consumed at school and then divide it by the number of school children. This gives the “daily water allowance” (supply of liters per person per day). The children will carry out the same procedure at home.</td>
</tr>
<tr>
<td>Continuity</td>
<td>Determine how many hours per day there is water in the school. Is the supply continuous or for a few hours only? These data are used to calculate the average working time of the service. The school children will find out the same data at home.</td>
</tr>
<tr>
<td>Condition</td>
<td>Carry out a sanitary inspection to see the condition of the tanks, deposits, pipes, and taps. Check for hygiene, soundness, breaks, faults, losses, and leaks, and identify at what point the water may become contaminated.</td>
</tr>
<tr>
<td>Cost</td>
<td>Examine the water bills for previous months and divide them among all the consumers in the school to establish the cost per person and see how much is being spent.</td>
</tr>
<tr>
<td>Culture</td>
<td>Make a list of examples of inappropriate group behavior with regard to the use of the water installations, deposits, and water consumption. Do the same to identify individual behavior that may cause contamination of the water.</td>
</tr>
</tbody>
</table>
GENERAL NOTE:

All these activities can be replicated in the children’s homes (and it is advisable that this be done). The results will be presented together, to see which attitudes need to be changed and which people need to change them.

NOTE ON REQUISITE 1: QUALITY

If the water is piped and has chlorine residual, a simple chlorine residual comparator will be sufficient (which works with the DPD reagent or orthotolidine one, O-T), like the one attached to the back cover of this book. The reagents required should be requested from the ministry of health offices, clinics, or companies that supply the drinking water service. In the case of O-T, all the school needs to do is to buy chlorine analyzer replacement parts for swimming pools, which are sold cheaply in any hardware store.

Regardless of the concentration (providing it is in a range of 0.1 to 2.0 mg of chlorine/liter of water, or, to put it another way, 0.1 to 2.0 p.p.m—parts per million—), the presence of chlorine residual should be regarded as sufficient safeguard that the water is properly disinfected and does not present microbiological contamination. If the water does not have chlorine residual, a bacteriological test of fecal coliforms should be performed to check whether there is contamination of fecal origin.

Although simple methods exist, it is nearly always better to ask for the support of an institution of environmental health or of the drinking water company, which should have the capacity for making these tests or at least know where such tests are carried out.

Both the presence of chlorine residual and the absence of fecal coliform bacteria indicate that the water quality is good.

NOTE ON REQUISITE 2: COVERAGE

This is easily determined. Merely find out where the water comes from, and if it is piped it can be said that all the school children are covered by the drinking water supply.
This should be complemented with the information regarding the coverage of each school child at home, so that the coverage data refer not only to the school but also to the population linked with the school, thereby providing information closer to the definition of the term “coverage”. In any case, this determination is merely for the purpose of helping the students understand the concept by means of simple statistics.

**NOTE ON REQUISITE 3: QUANTITY**

The school should supply the water bills which give the volume of water consumed monthly. If this information is not available, it can be obtained based on the volume of water entering the school and consumed; a simple bucket or other recipient can be used to measure the amount of water extracted or consumed. This is then divided by the number of students to obtain the “daily water allowance” or water supply (liter/students/day). This is an important piece of information because the greater the volume, the greater are assumed to be the habits of hygiene and sanitary safety. It has been estimated that the daily water allowance for a school should be 10 to 30 liters/student/day.

**NOTE ON REQUISITE 4: CONTINUITY**

The number of hours per day of water supply in the school should be counted. Ideally, it should be 24 hours. Anything less (which would indicate discontinuity) is a situation of risk and should be treated as such. This evaluation should also be done by the school children in their homes, to verify the risk of the community as a whole.

**NOTE ON REQUISITE 5: CONDITION**

To evaluate the condition of the system, a sanitary inspection should be carried out. This involves following the route taken by the water from its point of entry into the school (entry valves in the municipal mains), passing through the different elements of the system, to the taps where the school children and staff take the water to drink. Piping, valves, tanks or deposits, drinking fountains, and taps are thus included in the inspection. Such an investigation is important to be able to repair any failure identified. The group responsible must inspect the whole system and note down any deficiencies they detect. The following chart lists some typical problems.
### Carrying Out the Project in the School

<table>
<thead>
<tr>
<th>Element</th>
<th>The sanitary inspection should focus on</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piping</strong></td>
<td>Losses or leaks; defective joints; exposure that may result in breakage from accidental blows.</td>
</tr>
<tr>
<td><strong>Taps and valves</strong></td>
<td>Losses of any type; dirty rubber or plastic elements.</td>
</tr>
<tr>
<td><strong>Drinking fountains</strong></td>
<td>Losses of any type; system where the school children can make contact with their mouth; taps that are not working properly or are difficult to open or close.</td>
</tr>
<tr>
<td><strong>Tanks or deposits</strong></td>
<td>Losses of any type; cracks; visible dirtiness inside and outside the tank; no lid; no padlock on the lid; defective floating valve.</td>
</tr>
<tr>
<td><strong>Surrounding areas</strong></td>
<td>Puddles, stagnant water, marshes or muddy areas, flies attracted to the stagnant water.</td>
</tr>
</tbody>
</table>

| NOTE ON REQUISITE 6: COST |

The school will provide the receipts of the previous months' water bills, and by a simple division among the number of consumers in the school, the per capita cost will be calculated. This should be complemented by having the same exercise done by the school children in their homes.

| NOTE ON REQUISITE 7: CULTURE OF WATER |

The students will make a list of examples of inappropriate behavior in the use of the installations, deposits, and water consumption. The behavior should be classified in order to produce some statistics and know what is being done wrong and to what extent. This exercise seeks to reveal attitudes regarding hygiene, improper use and wasting of water, improper use of toilets, failure to wash hands, incorrect disposal of sewage, etc. This should be complemented by having the school children replicate similar exercises in their homes.
Step 3: Water quality control activities

The previous step made it possible to know the extent of the children's knowledge with regard to the quality of the water they drink and the condition of the water installations.

Any results confirming positive aspects should be highlighted and praised as something good to be maintained.

Results indicating the contrary should be used to encourage control (remedial) activities to solve the problems detected. It should be noted that in most cases the solutions are simple, cheap, and nearly always linked to changing attitudes and conduct or simple plumbing jobs rather than technologies that nobody understands or plentiful funds which are hardly ever available to a school in a developing country.

The control activities should be linked to the requisites. Some are mentioned in the following table.

<table>
<thead>
<tr>
<th>Requisite</th>
<th>Control activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quality</td>
<td>If there is chlorine residual, it should be tested daily. If there is no chlorine residual, regardless of whether the water is bacteriologically safe or contaminated, the school should proceed to disinfect the water by chlorinating, adding sodium hypochlorite or bleach (if the water is safe, this will be a preventive measure, and if it is contaminated, a corrective measure). There are many simple methods and ample information is available on how to disinfect water in schools and homes. The bacteriological tests should be repeated frequently, several times a year.</td>
</tr>
<tr>
<td>2. Coverage</td>
<td>If the coverage is low, an effort will be made to extend it through contacts with, and requests to, school authorities, municipal authorities, and the water supply company.</td>
</tr>
</tbody>
</table>
3. **Quantity**  
As in the previous point.

4. **Continuity**  
As in the previous point.

5. **Condition**  
Deficiencies detected during the sanitary inspections will be studied and solutions will be proposed. Some problems may be redressed with a change of attitude (which will involve promotion, awareness-building, supervision, and control) and others with simple plumbing repairs, which may sometimes be paid for by the school children's parents at no cost to the school.

6. **Cost**  
This will depend on each school, each community, and each individual case, but through the school cooperative a contribution could be requested, for example, for the payment of disinfectants, which could be very cheap, but this will instill in the student and his parents the concept of “value of water”.

7. **Culture**  
There are several activities that can be carried out in this reference, and they are linked to the following point which is that of building awareness, providing information, and controlling the attitudes of the school children with regard to hygiene, the use of water, and its value.

Without detriment to what has gone before, it should be emphasized that the program as a whole must build awareness on the one hand, and on the other it must solve eventual sanitary problems detected (sometimes it will suffice to put a lid on a tank or clean the tank to obtain a good improvement in water quality). It is suggested that the program continue with quality control of the water by tests (both of chlorine residual and bacteriological) with a frequency to be determined according to the possibilities of each individual school, but it is recommended that chlorine residual should be tested daily and bacteriological tests should be repeated once a month. Finally, advantage should be taken of the project to establish the practice of purifying the water consumed in the school, for example, by disinfecting it with sodium hypochlorite if the controls performed indicate the need for this measure.
Step 4: The second survey

The last point of the program is based on the results of the three previous steps. The results of the first survey will reveal how much the school children know, so that subsequent approaches or simple talks on water and water quality can be better designed. Whether it is a lot or a little, whether clear guidelines are issued by health authorities or a modest initiative is taken by the school principal and teachers, any information given to the school children will always be beneficial. What must not be lost from view is something that has been stressed throughout this publication: that a culture of water must be instilled, clearly establishing the relationship between drinking water and health, and developing an attitude of respect and care towards water as a resource that is not abundant and that is becoming increasingly contaminated and scarce.

For help in conducting campaigns there are many sources of information, both in the ministries of education, the ministries of health, and the environment, as well as related institutions and web sites on Internet.
Once the campaign has concluded, it is time to carry out the survey again as in Step 1. Although the questions can be modified, comparing the results obtained “pre-project” with the “post-project” results will make it possible to measure the progress made and success achieved. A lapse of 6-12 months is appropriate for the repetition of the survey. The whole process is illustrated in the following diagram.

![Diagram of Project Process]

**Steps**

- **Step 1**
  - What do we know?
  - Evaluation of knowledge

- **Step 2**
  - What kind of water are we drinking?
  - Evaluation of water quality

- **Step 3**
  - What should we do?
  - Control activities

- **Step 4**
  - What progress are we making?
  - Educational campaign and evaluation of results

**Procedure**

- Apply the survey
- Consolidate and analyze survey results

- Apply the «seven Cs and Qs»
- Consolidate and analyze results

- Put the control measures into practice
- Apply the recommendations of the «seven Cs and Qs»

- Conduct the educational campaign
- Apply the survey again and compare «before» and «after» results