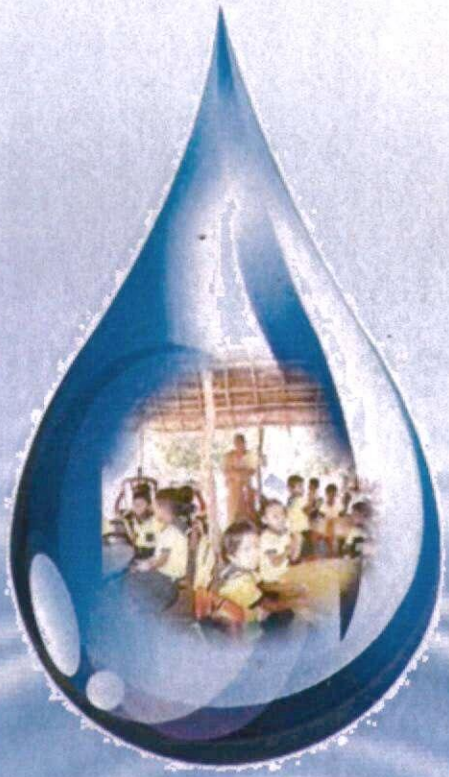
NATIONAL SCIENCE FOUNDATION

Adequacy and the Needs for Enhancing Water Science Teaching in Schools



Seminar Proceedings

12th January, 2010

National Committee on Hydrology
in collaboration with
National Committee on Science Mathematics and Technology Education

National Science Foundation
Sri Lanka

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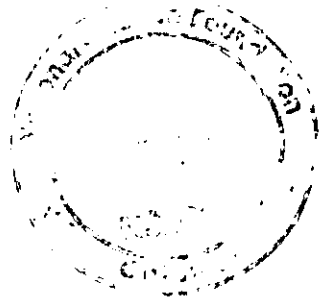

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Contents

Foreword

The seminar was organized by the National Committee on Hydrology (NCH) of the National Science Foundation in collaboration with the National Committee on Science, Mathematics and Technology Education (NCSM&TE) of the National Science Foundation and the National Institute of Education (NIE) on the 12th January 2010 at the NSF Auditorium.

During its regular meetings the National Committee on Hydrology discussed the importance of educating the general public on the importance of water, concerns with respect to issues such as water conservation, pollution and sustainable use. Committee was also of the opinion that it is important for the public to recognize the need to carryout measuring, monitoring and control of water resources so that the present and future generations could sustainably utilize this precious resource. The National Committee on Hydrology in its quest to achieve this awareness enhancement task in the most effective manner realized that it would be prudent to commence by addressing the needs of the school children. Accordingly the objective of the seminar was taken as the identification of adequacy and requirements for the enhancement of water science teaching in schools, with the intention of assessing ways by which National Science Foundation could make a significant contribution. From this seminar, the National Committee intends to evaluate the needs and list recommendations to map the way forward with respect to improving water science education in schools.

There are many who made valuable contributions to make this seminar a success. National Committee on Hydrology on behalf of the organizers of the seminar wishes to thank all resource persons who made extremely valuable contributions, all participants who expressed their experiences and extended their suggestions at the discussion groups, the Chairperson, Director, and the staff of National Science Foundation for their unstinted support.

Professor N.T. Sohan Wijesekera
Chairman/National Committee on Hydrology

National Committee on Hydrology

1. Prof. Sohan Wijesekera (Chairman)
   University of Moratuwa
2. Dr. S.A.K. Abayawardana
   National Science Foundation
3. Dr. Locana Gunaratna
4. Prof. Ananda Gunathilaka
5. Prof. H.D. Gunawardhana
   University of Colombo
6. Mr. K.A.U.S. Imbulana
   Ministry of Agriculture Development and Agrarian Services
7. Prof. (Mrs) Y.N.A. Jayatunga
   University of Colombo
8. Dr. A.M. Mubarak
   Industrial Technology Institute
9. Prof. K.D.W. Nandalal
   University of Peradeniya

NSF Representatives

Dr. Geethika Yapa
Head, Research Division, National Science Foundation

Ms. Anusha Amarasinghe
Head, International Liaison Division, National Science Foundation

Conference Coordinator

Ms Amali Ranasinghe
National Science Foundation

Programme

Seminar on "Adequacy and the Needs of Enhancing Water Science Teaching in Schools"
12th January 2010

9.00 a.m. – 9.15 a.m.	Welcome address *Prof. Sirimalie Fernando* *Chairperson NSF*
9.15 a.m. – 9.30 a.m.	Introduction to the Seminar *Dr. S. A. K. Abayawardana* *Director, NSF*

Technical Session 1

Chairperson : Prof. M.T.M. Jiffry, Chairman National Committee on Science, Mathematics &Technology Education

9.30 a.m. – 9.50 a.m.	Water science education in the context of current syllabi *Prof. Uma Coomaraswamy* *Programme Accreditation Analyst, Distance Education Modernization Project and Member, NCSM&TE*
9.50 a.m. – 10.10 a.m.	What could be the NSF contribution for teaching water sciences in schools – "Views from the Department of Education" *Mr. M. P. Vipulasena* *Science and Mathematics Director, Ministry of Education*
10.10 a.m. – 10.30 a.m.	What could be the NSF contribution for teaching water sciences in schools – "Views from the NIE" *Dr. I. L. Ginige* *Assistant Director General, NIE*

10.30 a.m. – 10.50 a.m. Tea Break

Technical Session 2

Chairperson : Dr. S. A. K. Abayawardana, Director NSF

10.50 a.m. – 11.10 a.m.	Lets be critical about water science education in Sri Lanka *Prof. H. D. Gunawardhana* *Senior Professor of Chemistry, UoC and Member, NCH*
11.10 a.m. – 11.30 a.m.	Water quantity and quality concerns, and adequacy and the needs of teaching water science in schools *Mrs. R. R. Ellepola* *Deputy Director General, CEA*
11.30 a.m. – 11.50 a.m.	Outreach programmes and concerns in water education in schools – "from the experiences of Brandix Lanka" *Mr. Prasanna Wijewardena* *Manager, Corporate Social Responsibility Division, Brandix Lanka Ltd.*
11.50 a.m. – 12.50 p.m.	Group work, discussion and recommendations to map the way forward
12.50 a.m. – 1.30 p.m.	Group presentations
1.30 p.m.	Lunch and End of Seminar

Report of the Seminar

The seminar was held on 12th January 2010 from 9.00 a.m. to 1.30 p.m. at the NSF Auditorium. Total of 35 participants attended representing universities, ministries, authorities, national schools, departments, boards, institutes and the private sector. Prof. Sirimali Fernando, Chairperson NSF delivered the welcome address. Dr. S. A. K. Abayawardana, Director NSF gave the introduction to the seminar emphasizing why water science teaching is important in the school curriculum as water is a valuable natural resource to all.

The first session of the seminar consisted of three presentations and was chaired by Prof. M.T.M. Jiffry, Chairman, National Committee on Science, Mathematics &Technology Education. Water science education in the context of current syllabi was presented by Prof. Uma Coomaraswamy, elaborating the present syllabi of water science teaching in each grade. Mr. M. P. Vipulasena and Dr. I. L. Ginige made presentations on what could be the NSF contribution for teaching water sciences in schools – "Views from the Department of Education" and "Views from the NIE" respectively. The second session was chaired by Dr. S. A. K. Abayawardana (Member of the National Committee on Hydrology). The first presenter Prof. H. D. Gunawardhana, was very critical about water science education in Sri Lanka. Mrs. R. R. Ellepola presented how the Central Environmental Authority addresses the concerns of water quantity and quality and Mr. Prasanna Wijewardene from Brandix Lanka Limited expressed the views of the private sector while stating their present activities in the water sector.

The group work was carried out by dividing the participants into three groups and each group presented their three suggestions according to major titles as;

- Recommendations to the NIE to improve the current syllabi
- Suggestions with respect to the teaching methodology
- Taking the Initiative Forward: Suggestions to the NSF

The National Committee on Hydrology in collaboration with the National Committee on Science, Mathematics & Technology Education will address the above suggestions with a view to formulate recommendations for enhancing water science teaching in schools.

Amali Ranasinghe
Coordinator

Composition of Work Groups

GROUP A

Facilitator : Ms. Amali Ransinghe

1. Prof. Uma Coomaraswamy (Group leader)
2. Mr. M.H.J.P. Gunarathna
3. Ms. A.D. Ampitiyawatta
4. Mr. K.A. U.S. Imbulana (Presenter)
5. Mr. K. M. R.Anthony
6. Mr. T. W. A. W.Wijesinghe
7. Mr. M. N. A.Mubarak
8. Mr. Rohan Wijesuooriya
9. Mrs. Kalyani Dasanayake
10. Mrs. M. Jagapriyan
11. Ms. R. Chandralatha
12. Mr. Shanaka Piyatissa

GROUP B

Facilitator : Dr. Sachie Panawala & Ms. Sujini Gamage

1. Dr. I .L. Ginige (Group leader)
2. Prof.(Mrs)Y. N. A. Jayatunga
3. Prof. S. S. Wickramasinghe.
4. Prof. Ananda Gunatilaka
5. Mr. A. A. de Silva (Presenter)
6. Eng. Miss R.A.D. Jayanthie
7. Mrs. Sajeevika Perera
8. Ms. Jayani Sooriyapperuma.
9. Mr. Prasanna Wijewardena.
10. Ms. S. K. Ruwanpathirana
11. Ms. A. G. P. Wimaladasa
12. Ms. Harini Mapa Gunaratne
13. Ms. S. M. C. G. Wijesekara

GROUP C

Facilitator : Ms. Nadeera Jayaweera

1. Prof. H. D. Gunawardena (Group leader)
2. Dr. H. A. H. Jayasena (Presenter)
3. Mr. Janaka Gunarathne
4. Mrs. D. D. Premawathie
5. Ms. Chethika Ambalangodage
6. Mr. Rohan Weerasooriya
7. Mr. A. D. A. De. Silva
8. Mr. Sanka Piyatissa
9. Mr. Prasanna Wijewardene
10. Ms. S. M. Visaka Samaraweera
11. Ms. U. L. Vineetha Pushpalatha Perera.
12. Ms. A .A. W. Jayawicrama.
13. K. Jinapala

Seminar Recommendations

(1) Recommendations to improve the current syllabi

1. Testing water quality as a practical exercise of the curriculum and to supply low cost kits for testing
   - Use school children to monitor water quality in water bodies.
   - Make low cost testing kits available to schools.

2. Prepare some DVDs, VCDs on water quality testing
   - Prepare a short video on Water Conservation in Sri Lanka.

3. Contents to be introduced
   - Pollution prevention on the basis of uses
   - Irrigation
   - Hydropower
   - Recreation
   - Biology syllabi – More details on microbiological, chemical quality of water. Biological indicator for the syllabi to determine the level of water pollution – Grade 6 students

     According to the new syllabi there is a flow of water science from grade 6 to 13. However include additional video programmes related to water science and introduce interesting experiments related to water.

   - Physics – Water management
   - Sustainable use of water
   - Quality aspects and standards to be added and supplementary material for the curriculum on appropriate competency levels.
   - It is important to add a section on water resources in Sri Lanka and monitoring of water quality parameters. However this should not be repeated in different syllabi.
     eg: in Biology & Chemistry. Inter-disciplinary dissociation is important (between subjects).
   - Organize a workshop for identifying the subject areas to be included into the syllabi on water science.
   - Water as a economic good.
   - Tank based culture in Sri Lanka - Grade (9)
     - Principles
     - Components
     - Management

4. Widening concepts related to water (across the curriculum)
   - Select most relevant contents by a team of experts and introduce to the curriculum

5. Additions or deletions should be recommended in a systematic way – preferably on the basis of a Conceptual Model

(2) Suggestions with respect to teaching methodology

1.A module to discuss present content through new approaches

- Case studies
- Physical models
- Project work
- Videos
- Field visits
- Activity based learning
- If possible include field visits to expose students to issues related to water problems and to identify the corrective actions
- Exposure to real water related problems
- Competency – based, student - centred, activity – oriented methods should be newly introduced
- Organize working groups in class rooms
- Practical aspects not emphasized at class level
- Class projects at field level
- Provide resources for training of students
- Environment related teaching

2. Capacity building of teachers through ISA (In Service Advisors). The ISAs should be trained by the NIE and they should train others in the respective provinces. Although this is currently being done, it is not very effective. Therefore to make it effective and efficient.

3. Extensive teacher training should be done to familiarize with the methodology.

4. Teacher presentation/motivation to accommodate the proposed changes

   - The methods are in place, but some teachers should be educated or trained according too standards in order to serve as expected.
   - Teachers should have sufficient practical knowledge.
   - Facilitate teachers to have classroom practice.
   - Use of correct methodology as teaching aids. For example models, pictures and specimens (living or non living).
   - Commencement of training programmes for teachers on how to use test kits for various parameters.

5. In adequacy of time allocated to introduce teaching methodology

   - Teaching methodology needs to be improved with case studies, physical models & field visits.
   - Teaching methodology needs to be improved while reviewing what has already being done ensuring student workload norms.

6. Students to be taught on the application of basic principles in science to solve real world problems.

   - Through the exposure of the students to real life situations.

7. Other comments

- Present day students have a heavy load of home work.
- They are not only large quality but also difficult and mostly done by their parents.
- Teaching need to be focused on disseminating knowledge.
- Important points for learning, teaching should include -
  Knowing the subject matter
  Knowing your students
  Simple ways of communication
  Promote students motivation

(3) How Can the NSF Help to Take This Initiative Forward?

1. Make the relevant authorities aware

   - NSF can play a major role to tap the experts in this field and disseminate the knowledge to the relevant authorities to upgrade the water education in schools.

2. Preparation of DVDs, VCDs on water sciences

   - As a bridging institute mainly among scientists, researchers and stake holders their finding to be sent to the school system in a simpler language
     Posters
     Simple DVD's on special topics.

3. NSF could provide resource persons for teacher training and preparation of a manual

   - Prepare a manual containing theories and practices that is suitable for all the grades and distributing it to the schools
   - NSF can help NIE to implement teachers' practical knowledge.

4. Seminars and workshops for teachers as well as for students

   - Organize programs to enhance knowledge through a seminar series.
   - NSF can organize on awareness programme among the school children on World Water Day (WWD) specifically on water education.
   - NSF can organize seminars, workshops for teachers (selected) from each category (grades) in all provinces in collaboration with the Department of Education.
   - Can help in conducting training programs for teachers providing resource persons.
   - Start training programmes for teachers as how to use the test kits for various parameters.

5. Preparing a module

   - Develop a 'Water Science' model to facilitate and enhance the learning – teaching process for teachers.
   - NSF could support capacity development of teachers by producing a Module on W/Sc consisting of Learning – Teaching Activities
   - NSF can help to prepare a module as Dr. Ginige proposed and a separate booklet with all information and funds the training programmes.

6. Supporting research relevant to school education

   - Motivate school teachers to do research on water related topics
   - Do a research at national level to find a link between ground water pollution and chemicals used in agriculture using school children as their projects.

7. Transfer research findings to schools

   - NSF should use its web site and data bases to disseminate information.
   - Informal Education (handouts, fact sheets)
   - Sharing new research findings (global research as well to be included)

8. Facilitation and coordination between different stake holders

   - Play a facilitator role by bringing relevant parties together.
   - Close contact with the organizers who are really experts on water related work and transfer the technology to NIE

9. Other

   - Always keep in touch with NIE and motivate them to plan programs that are introduced to schools.

   - Discussions with students and get them to write notes or comparisons

Annexes

Annex 1: Presentations by Invited Speakers

Annex 2: List of Participants

Annex 3: Seminar Photographs

Annex 1: Presentations by Invited Speakers

1. Water science education in the context of current syllabi

2. What could be the NSF contribution for teaching water sciences in schools – "Views from the NIE"

3. Lets be Critical about Water Science Education in Sri Lanka

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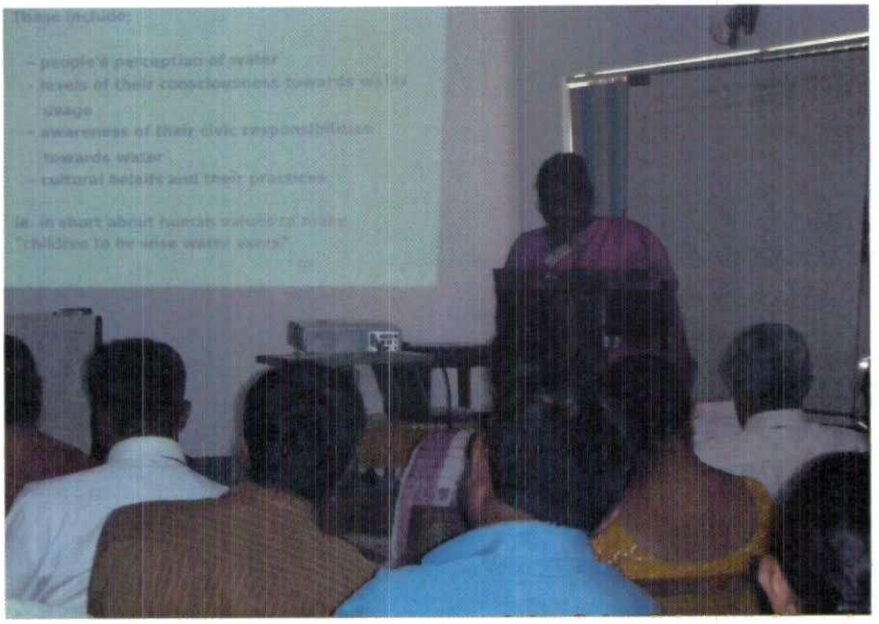
5. Outreach programmes and concerns in water education in schools – "from the experience of Brandix Lanka"

ANNEX 1-1

Water science Education in the Context of Current Syllabi

ANNEX 1-1

Water science education in the context of current syllabi



Prof. Uma Coomaraswamy
Programme Accreditation Analyst, Distance Education Modernization Project and Member, NCSM&TE

Water Science Teaching in Schools - Context of Present Curriculum

Uma Coomaraswamy
Emeritus Professor of Botany, OUSL

Member – National Committee
on Science Technology and Mathematics Education/NSF

What are we looking for:

- **Broad aim is to facilitate changes in behaviour and personal attitudes among water consumers and to promote better understanding of the environment in a water context.**

  To achieve this it is important to develop capacity in schools and communities.

  Question posed by the National Committee on Hydrology is perhaps "is water science covered adequately in the school curriculum?". If not what could be done?

Schools

- **Water education is not just about water literacy (i.e. knowledge of the science of water, types, sources, uses, pollution, treatment, water borne diseases, management and its associated problems)**

  These are important tangibles.

Schools

- Equally important is about intangible things. These include;

  - people's perception of water
  - levels of their consciousness towards water usage
  - awareness of their civic responsibilities towards water
  - cultural beleifs and their practices

  ie. in short about human values to make "children to be wise water users"

Schools

- It is in this context the National Committee on Science, Technology & Mathematics Education of NSF, when requested by National Committee on Hydrology , decided to contribute through reflecting on the extent to which school curriculum deals with water education per se in Science (for Grades 6 to 9) and Biology & Chemistry (for grades 10 to 13) .

Schools

- However it must be recognised that water is an integral part of life & life processes and hence, the curriculum has to be looked at in totality.

- Further social and economic aspects of water also has to be considered.

Schools

- Present science curriculum has a good knowledge base in water.
- The concept of value based education is not alien to our educational system.
- Primary objective of the new curriculum reform had been
  - to alleviate the shortcomings in the previous curriculum ,
  - reduce workload of students
  - and to minimise the curriculum gap between junior secondary, GCE O/L & GCE A/L

In the present educational system

- for junior secondary(grades 6-9), science subject is introduced as an integral common science curriculum and for senior secondary (grades 10-13) science is taught as subject curriculum Biology, Chemistry Physics, Maths etc.
- a new approach is introduced to provide opportunities to amalgamate theoretical aspects and hands-on/field activities.

Curriculum

- the curriculum consists of a set of
  - competencies
  - competency levels
  - continuum of activities with a set of activities together which provides opportunities to extend the learning teaching processes beyond the classroom environment.

Curriculum

- there is a visible transformation of the teacher's role. Teacher's task is to be a facilitator in transmitting through multiple learning teaching methodologies knowledge base determined under competency levels.
- It is the task of the teacher to regularly examine the learning students receive based on the activities and encourage them to learn.

Curriculum

- To help in this Teachers Instruction Manual includes the detailed syllabus, activity continuum (that helps in implementation of the syllabus) and instruments for the extension of the learning teaching process.
- Teachers will have to understand and conform to a student-centred , competency based and activity focused transformational role.

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Comptency/Competency level	Time in minutes or periods
Water as a part of ecosystem/abiotic environment	· 1-5 Environment related activities	Encompassing competence of a number of disciplines	6-7 hours/out of total of 16-17 instructional time per week
	· 6 : Science	1.3	40 minutes
	· 7 : Science	1.2, 1.3, 1.4	60 minutes
	· 8 : Science	3.5	40 minutes
	· 11 : Biology	3.2	20 minutes
	· 12 & 13 : Biology · : Chemistry	12.1.4, 16.4	4 periods 5 periods

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Aquatic Plants and Animals	· 6 : Science	3.2, 4.2	160 minutes
	· 8 : Science	1.1	40 minutes
	· 11 : Biology	2.5	120 minutes
Hydrosphere/Hydrological cycle	· 6 : Science	5.2, 5.3	160 minutes
	·11 : Chemistry	4.1	30 minutes
	· 12 & 13 : Chemistry	16.1, 16.2	12 periods

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Importance of water to the existence of organisms	· 6 : Science	5.6	120 minutes
	· 7 : Science	7.3	40 minutes
	· 10 : Biology	3.1	20 minutes
	· 11 : Biology	1.3	40 minutes
	· 12 & 13 : Biology	4.1.2, 4.1.3 2.1.2, 2.4.3 13.1	4 periods 3 periods 7 periods

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Water in matter/interaction with other chemicals	· 8 : Science	2.2	20 minutes
	· 9 : Science	4.4	30 minutes
	· 10 : Chemistry	3.3	60 minutes
	· 11 : Chemistry	2.2	60 minutes

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Water pollution, treatment, management of waste water, etc.	· 6 : Science	5.6, 5.7	240 minutes
	· 11 : Biology	3.3	120 minutes
	·11 : Chemistry	5.2	120 minutes
	· 12 & 13 : Biology	13.2.1	7 periods
	· 12 & 13 : Chemistry	16.7	3 periods

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Water as energy source	· 6 : Science	7.2	120 minutes
	· 7 : Science	6.5, 6.7	120 minutes
	· 8 : Science	5.4	30 minutes
	· 9 : Science	3.3, 3.4	120 minutes

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Water in the context of natural disasters	· 6 : Science	8.1, 8.2	60 minutes
	· 7 : Science	8.1	120 minutes
	· 8 : Science	8.1	120 minutes
	· 9 : Science	8.1, 8.2	240 minutes

Present School Curriculum in Water - Context

Broad Areas directly mentioning water	Grades and subject	Competency/Competency level	Time in minutes or periods
Diseases and water	• 12 & 13 : Biology	13.1.3, 13.3.1 14.1.3	2 + 4 + 2 periods
Aquaculture	• 12 & 13 : Biology	14.1	8 periods

Overall Comments

- Water related topics are found in various extent in the school curriculum.
- One may feel that at A/Ls physical science curriculum may be deficient in water education.
- The integration of values into the various curriculum ensures the reinforcement of the efforts of the educational system in inculcating pupils the right attitudes and values. Activities allow all subjects in school education to proceed with efficient integration of human values in all subjects.

Overall Comments

- If certain competencies /competency levels need be covered at the expense of some others it has to be done in such a way that it does not add to the load the student has to carry.
- It has to be borne in mind that curriculum is planned for a certain period of time and done with great care by panels appointed by NIE. Adhoc changes have to be avoided.

Overall Comments

- Even with a good curriculum and teachers Instructional Manual the important question is how well the teachers transmit the knowledge , skills and values.
- How well the students learn through the transformational role of teachers.
- Do the teachers have the capacity to teach the way they are expected to teach?

Overall Comments

- Is capacity building and skills training of teachers done regularly on a continual basis island-wide?
- Is student learning assessed & if not remedial measures taken by the relevant authorities?
- This is where attention is most needed.

ANNEX 1-2

What could be the NSF Contribution for Teaching Water Sciences in Schools – "Views from the NIE"

ANNEX 1-2

What could be the NSF contribution for teaching water sciences in schools – "Views from the NIE"

Dr. I. L. Ginige
Assistant Director General, NIE

Seminar to Promote Teaching of Water Science in Sri Lankan Schools

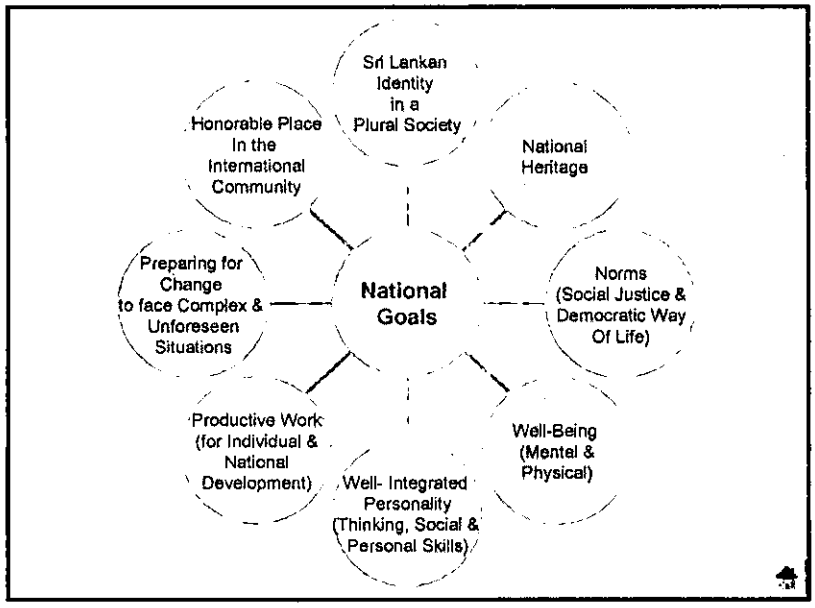
Dr (Mrs) Indira Lilamani Ginige
Assistant Director General

Faculty of Science & Technology
National Institute of Education

What could the Interested Parties do?

1. Go through the eight to see whether there is a place for teaching of Water Science in Sri Lankan Schools.
2. Be familiar with the introduced under Curriculum Reforms – 2007.
3. Get an idea on by going through a more comprehensive classification.
4. Develop a to facilitate the identification of a set of Subject Competencies on Water Science suitable for school children.
5. Analyze the National Curricula at Junior Secondary Level (grades 6-9) and Senior Secondary Level (grades 10-13) to identify the extent to which the above competencies are covered.

6. Identify under competencies and disperse them across the grade structure to facilitate teaching of Water Science in schools.
7. Be familiar with the new of the teacher in the light of the Constructivist Approach to Learning and Teaching.
8. Study the incorporated in the Teachers' Instructional Manuals (TIMs) for Learning and Teaching of Water Science.
9. See how existing activities can be adapted or new activities can be developed for a Module on Water Science.
10. Pilot the Module selecting relevant grades of the school system.
11. Write a section on how to use the module to help Teachers of Science undertake self study for familiarization on Subject Matter Knowledge (SMK) and Pedagogical Content Knowledge (PCK).
12. Print module and distribute to schools.



Competency

K Knowledge

A Attitudes

S Skills

Interpersonal Ability

P Practice

Types of Competencies

Subject Independent Competencies

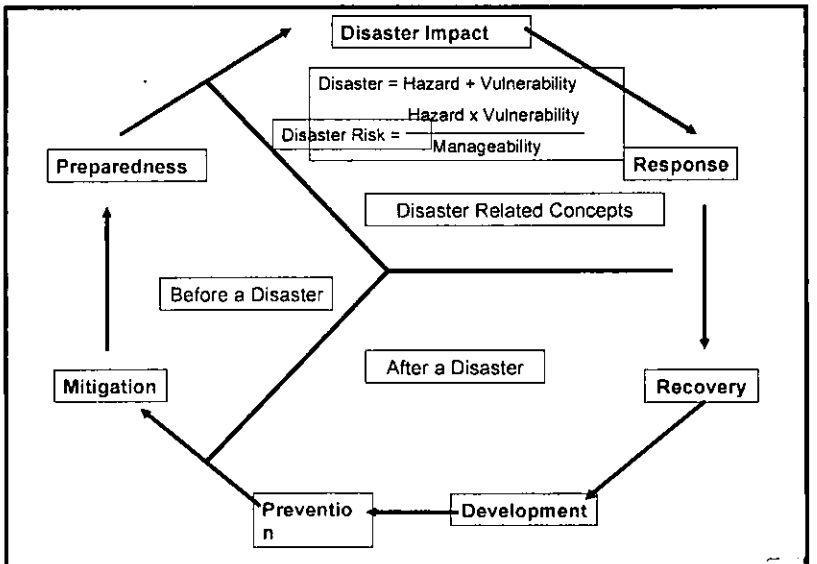
- Derived from the learning-teaching process
- eg: Works co-operatively in groups

Subject Dependent Competencies

- Derived from individual subjects
- eg: Investigates the environment as a Scientist

Subject Independent Competencies

- **Communication**
  - Literacy, Numeracy, Graphics and Use of IT for Communication.
- **Information**
  - Evaluation and Acquisition, Organization and Maintenance, Interpretation and Communication and Use of IT to handle Information.
- **Thinking**
  - Creative, Critical, Analytical, Logical, Divergent Thinking, Initiative, Decision Making, Problem Solving, Seeing Things in the Mind's Eye, Self Learning, Exploring, Discovering and Reasoning.
- **Personal**
  - Responsibility, Self Esteem, Sociability, Planning and Organizing, Self-Management, Self Discipline, Integrity, Emotional Intelligence, Productive Use of Leisure.
- **Interpersonal**
  - Team Work, Teaching Others, Serving Customers, Exercising Leadership, Negotiation, Tolerance and Respect for Human Dignity.
- **Environment**
  - Social, Biological and Physical Environment.



Model for Introducing Concepts on Disaster Risk Manageme

Competency 11.0

Takes action to maintain quality of water

Competency Level 11.1

Investigates the standards set for water quality

Content

- Variables that determine the quality of water
  - Conductivity
  - pH Value
  - Amount of Dissolved Oxygen
  - Total Dissolved solid
  - Presence of Micro Organisms
- How above variables affect the quality of water

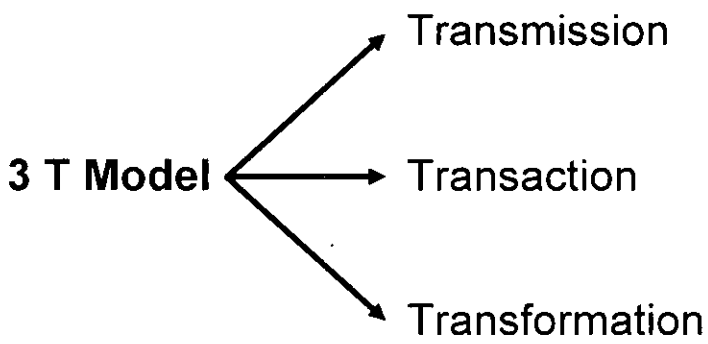
Competency Level 11.2

Investigates the factors that affect optimum composition of water used for different purposes.

Competency Level 11.3

Conduct laboratory tests to check quality of water

Role of the Teacher



5 E Model for Activity Planning

Engagement	→	Step 01
Exploration	→	Step 02
Explanation		
Elaboration	→	Step 03
Evaluation		

Format for Activity Plan

Competency 1 :
Competency Level 1.1 :
Activity 1.1 :
Time : ... Minutes
Quality Inputs :
Learning-Teaching Process :
- Step 1.1.1 :
- Step 1.1.2 :
- Step 1.1.3 :

Criteria for Assessment and Evaluation :

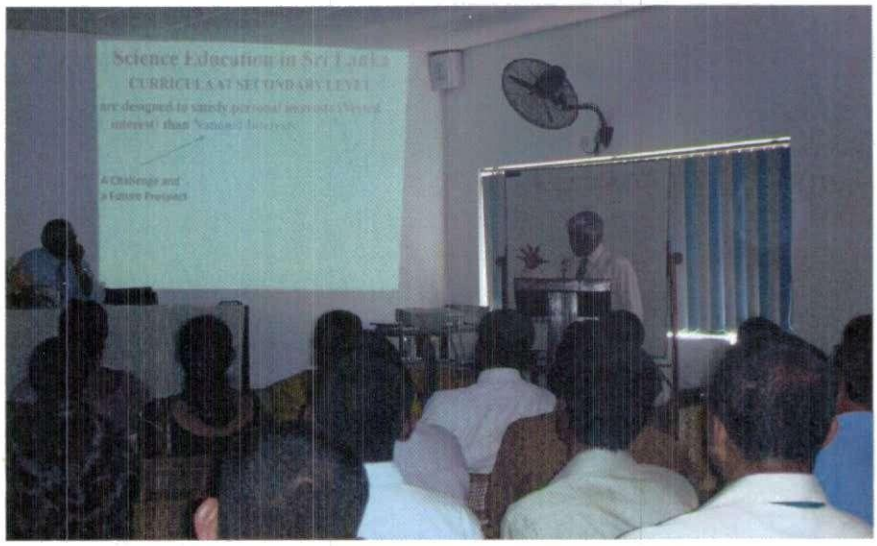
- Three from the Subject in Order of Difficulty
- Two Subject from the Learning-Teaching Process

ANNEX 1-3

Lets be Critical about Water Science Education in Sri Lanka

ANNEX 1-3

Lets be Critical about Water Science Education in Sri Lanka



Prof. H. D. Gunawardhana
Senior Professor of Chemistry, University of Colombo
and
Member, National Committee on Hydrology

Lets be Critical about Water Science Education in Sri Lanka

Senior Professor of Chemistry, University of Colombo
Chairman, Sri Lanka Accreditation Board for Conformity Assessment (SLAB)
Past General -President , Sri Lanka Association for the Advancement Science (SLAAS)

"Education determines the economy of a Country". Over 90% of Sri Lankans possess the ability to use the language of words. Similarly, over 90% of students who learn science subjects possess the ability to reproduce the subject matter as it is. Should we claim that the 'literacy' of science education is over 90%? Science education is the transfer of knowledge / skill in the scientific principles from the teacher to the student. The transfer is inadequate if the student does not possess the ability to use the knowledge/skill when the need arises. In accordance with the modern view, a teacher does not transfer, instead he facilitates the transfer of knowledge. The teacher is a facilitator who only assists the student to develop the ability. The ability to use the knowledge/skill in scientific subjects when the need arises is considered as the 'literacy' in science education.

An average student will not automatically develop the ability to use the knowledge/skill when the need arises unless he practices. It is like any other activity in life, e.g. Driving a car, Riding a bicycle etc. The most important way that an average student will develop this ability is by 'self-learning' after the knowledge is transferred from the teacher. The best self learning is the reading of text-books. An average student may require to read the text-books several times to achieve proper understanding of the principles he learnt. Even though the time required for such a process varies from student to student it will not only be helpful for student to gain a better knowledge in the particular science subject but it will also be useful to acquire the ability to use the knowledge in science when the need arises. Since it is a very slow process it has to be initiated at least at the secondary level of education. A student who has undergone the training of this self-learning practice, after the completion of his learning of scientific subjects will be a citizen who possesses a great potential to contribute towards economic the development of the country. Is the 'literacy' in science education achieved today?

Today the self-leaning aspect of scientific subjects is not popular among the science students due to the popular examination oriented study prevailing among students who only study the answers to a particular set of questions. Therefore, an average student who learnt science subjects is not 'literate' in the subjects.

In order to achieve the National Goals the curriculum at the G.C.E.(A/L) should cater to the 97% of the students who do not gain admission to Universities in Sri Lanka. At present, the course contents in all science subjects are geared for the minority (3%) who enter the Universities. In many developed countries, the personnel who have written and published books for the Secondary level are not allowed to participate in the designing or the revision of the course content. This is because the vested interest inadvertently predominates over the National interest. Since there is no such a rule in Sri Lanka the students who offer science subjects at G.C.E.(A/L) do not find any usefulness of the subjects if they fail to gain admission to the Universities. Sri Lanka suffers because the vested interest predominates over the national interest. A frequent revision of the curricula is essential to suit rapid changes in some aspects of scientific knowledge. It is suggested that a permanent body should undertake revision of the curricula of science subjects at G.C.E. (A/L) after conducting research on the aspects of catering to 97% of the students. This is cost effective since it helps in the development of the knowledge economy of the country. Nearly 2,400 years old irrigated agriculture, which was responsible for sustainable development of Sri Lanka in the ancient time, has not been given adequate consideration in the education system in Sri Lanka.

Is the irrigation water quality a part of our school curriculum? No! Because there are no irrigation tanks (reservoirs) in the United Kingdom (UK) or in the United State of America (USA) (Lakes only!). Sri Lanka blindly follows the UK and the USA, and has taken no steps to incorporate irrigation water quality criteria in teaching even though we have about 35,000 irrigation water tanks. The Science curricula of the G.C.E. (A/L) are designed to maintain the international standard such that students of the affluent families who fail to gain admission to local universities may find places in foreign universities without sitting for another examination. At present, the course contents in all science subjects are geared for the minority (3%) who enter the Universities. There is a very high resistance from many sectors in the revision of the curriculum suitable for local conditions such that about 97% students who could not gain admission to local universities are benefited. An urgent global issue by *Hishashi Kondo states that n*o one has died directly from Global Warming; but water shortages

and water pollution cause Four Million deaths per year around the world. This means one person dies every 8 seconds. This is applicable to many third world countries. Developed Countries are affected by global warming, ozone depletion etc. therefore, a Consultant from a Developed Country always convinces Educationalist in Sri Lanka or even insists the incorporation of global warming, ozone depletion etc into curricula at the Secondary Level. The Unit 14.6 of the Chemistry curriculum of the G.C.E. (A/L) implemented in the past several years is the only section on water –requesting to study "Quality of water, its solvent property, its oxidizing properties, its hardness and the removal hardness." The Standards adopted in Sri Lanka are given in the following Tables.

Table 1: Ambient Water Quality Standards for Irrigation and Agriculture, Central Environmental Authority(CEA)

Parameter	Unit	Standard limit
Total Dissolved Solid (TDS)	mg /l	500
Conductivity	dS/m	0.7
Sodium Adsorption Ratio(SAR)		6 - 15
pH		6.0 –8.5
Dissolved Oxygen	mg/l	3

The conductivity was in the GCE(A/L) chemistry syllabus about 40 years ago. It was removed in one of the syllabus revision due to vested interest but it has wide applications in the industrial sector in Sri Lanka. Out of the parameter listed in the Table 1, a student who has offers science subjects at GCE(A/L) can understand only two parameter namely. pH and Dissolved Oxygen. However, the Henry law which governs the dissolution of oxygen was removed from the syllabus due to personal interest. In the mean time Raoult law which is useful for distillation is done extensively encouraging the students to set up distillation plants.

The relative proportion of sodium to other cations is determined by the sodium adsorption ratio (SAR). Any increase in the SAR of irrigation water increases the SAR of the soil solution, which ultimately increases the exchangeable sodium by the soil leading to the loss of soil permeability. This has happened in certain irrigated areas. It is not ruled out that loss of soil permeability leading crop failure will not occur in other irrigated areas including Mahaweli.

$$SAR = \frac{Na^{+}}{\sqrt{Ca^{2+} + Mg^{2+}}}$$ where ionic concentration of each is in mmol dm^{-3}.

. Is the irrigation water quality a part of our school curriculum? No! In the recent revision of the GCE (A/L) science curricula these have been incorporated. (Chemistry)

Table 2: Drinking water standards – World Health Organization(WHO)

Criterion	WHO Recommended limit	International Acceptable limit	Tolerance limit
Total residue, mg dm^{-3}	500	1500	-
Turbidity, NTU	5	25	-
Carbon: chloroform extract, mg dm^{-3}	0.2	0.5	-
Fluoride (F) mg dm^{-3}	1.5	1.0 – 1.5	-
pH	6.5 – 8.5	6.5 – 9.2	-
Iron (Fe) mg dm^{-3}	0.3	1.0	-
Nitrate (NO_3) mg dm^{-3}	50	45	-

The healthy living is directly related to the availability of potable water of suitable quality. Hydrogeological study shows that the nature of rocks affects the quality of ground water. The groundwater in the some areas of North-Central Province contains excessive amounts of fluoride. The health effects of these have been studied extensively. It is generally assumed that water is purified and becomes suitable for drinking by boiling. Boiling only makes water free from pathogogens.

Table 3:- Quality of Effluents - Sri Lanka Standards Institution(SLSI)

No.	Determinant	Tolerance limits for effluents discharged into surface waters	Tolerance limits for effluents discharged into marine coastal waters	Tolerance limits for effluents discharged on land for irrigation purpose.
1	pH	6.0 – 8.5	6.0 – 8.5	5.5 – 9.0
2	Temperature, °C	40	45	35
3	BOD, mg dm^{-3}	60	100	250 (100)
4	COD, mg dm^{-3}	400 (250)	400 (250)	650 (300)
5	Chloride, mg dm^{-3}	1000	Not applicable	-
6	Chromium(VI), mg dm^{-3}	0.5	0.5	0.5
7	Chromium(Total), mg dm^{-3}	2.0	2.0	2.0
8	Sulfide, mg dm^{-3}	2.0	5.0	-

Chemical Oxygen Demand (COD) (Table 3) is a well known water pollution parameter for industries but a student who offers science subjects at GCE(A/L) cannot understand SLSI standard given in the Table 3.

$$(CHO)_n(aq) + O_2(aq) \rightarrow xCO_2(g) + yH_2O(l)$$

Amount of oxygen required in mg dm^{-3} to carry out this oxidation chemically is called chemical oxygen demand (COD)	Amount of oxygen required in mg dm^{-3} to carry out this oxidation by biological means (microorganisms) is called biological or biochemical oxygen demand (BOD)

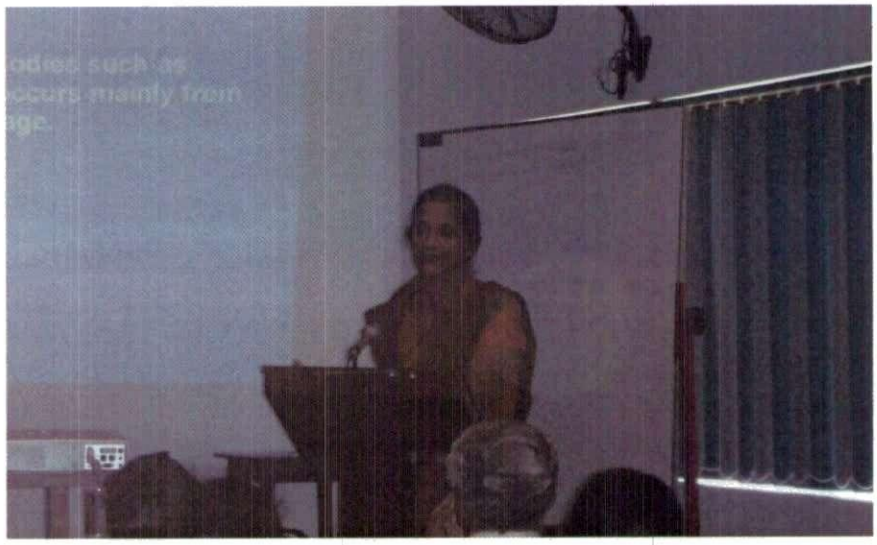
Teaching of scientific principles as applied to day to day life, laboratory and Environment and Evaluation geared towards the testing of the ability to use the knowledge when the need arises will undoubtedly fulfills the above needs. Does the traditional Science Education in Sri Lanka provide the TRAINING use the knowledge when the need arises? It mainly provides students to imagine the so called SCIENCE inTEXT BOOKS.. There are several examples where the knowledge is confined to text books and not the applications to lab. or day to day life.

ANNEX 1-4

Water Quantity and Quality Concerns, and Adequacy and the Needs of Teaching water Science in Schools

ANNEX 1-4

Water quantity and quality concerns, and adequacy and the needs of teaching water science in schools



Mrs. R. R. Ellepola
Deputy Director General, CEA

Water Quantity and Quality Concerns & Adequacy and the Needs of Teaching Water Science in Schools

Ramani Ellepola
Deputy Director General (EM&A)
CENTRAL ENVIRONMENTAL AUTHORITY

Pollution of Inland Water Bodies

Pollution of Inland Water Bodies such as rivers, lakes and lagoons occurs mainly from non point sources i.e. sewage.

In developing countries such as Sri Lanka, pollution from sewage occurs mainly due to the lack of adequate sewerage treatment facilities in urban areas.

eg :- ***Colombo – No treatment for sewage – simple discharge into the ocean***

Pollution of Inland Water Bodies – Contd.

- Pollution of Inland Water Bodies also occurs due to the discharge of industrial effluents.
- Since 1990 Industrial Effluent Standards were been gazetted by the CEA.
- Industries are required to meet the CEA standards depending on the final discharge point of the effluents.
  (*Eg. Inland surface water body, coastal waters, irrigation)*
- In discharging industrial effluents into Inland water bodies, 1:8 dilution factor is required, which may not be always available in all water bodies.

Industrial Effluent Standards

- Tolerance limits for the discharge of industrial water into Inland Surface Waters
- Tolerance limits for industrial water discharged on land for irrigation
- Tolerance limits for Industrial and Domestic Water discharged into Marine Coastal Water
- Tolerance limits for water from rubber factories discharged into Inland Surface Water
- Tolerance limits for water from Textile Industries
- Tolerance limits for water from Tanning Industries
- Tolerance limits for discharge of effluents into public services with Central Treatment Plants

Industrial Effluent Standards

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- Tolerance limits for water from Textile Industries
- Tolerance limits for water from Tanning Industries
- Tolerance limits for discharge of effluents into public services with Central Treatment Plants

Ground Water Resources

A major shortcoming in Sri Lanka is that Ground Water Resources are not being regulated in the same manner that surface water is being regulated.

Problems

- Uncontrolled extraction of Ground Water by industries
- Lack of data on Ground Water Quality and Pollution Levels.
- Pollution of ground water table from leachate arising through haphazard disposal of solid waste

Important Water Quality Parameters

- Dissolved oxygen
- Biochemical Oxygen Demand – BOD represents the amount of bio degradable organic material eg. From sewage and industrial waste water. BOD is a measure of pollution load.
- Salinity
- Phosphate and Nitrogen
- Free Ammonia – toxic to aquatic organizations even at low concentration
- Heavy metals – such as Chromium, Lead, Cadmium and Mercury are very toxic to human even at low concentration as the levels can build up.
- Faucal Coliform – Number of feacal coliform is indicative of the degree of contamination of water with sewage

Ambient Water Quality Standards

Following use classes have been identified for Sri Lanka

Class I
1. Nature Conservation
2. Drinking water source with simple treatment

Class II
3. Bathing and recreation
4. Fisheries and Protection of Aquatic life
5. Drinking water sources with conventional treatment

Class III
6. Irrigation and other agricultural uses
7. A *minimum* quality class, that makes water suitable for the following uses

    Cooling water and process water supply for non food industries
    Hydro power
    Fish survival
    Navigation
    Controlled waste water disposal

Class 7 is proposed as a minimum water quality requirement for all water bodies. All Inland Surface Waters should meet the requirements for one class7 .

Ambient Water Quality Standards

- Ensuring a suitable water quantity cannot be achieved without monitoring of actual water quality.
- Systematic water quality monitoring is a part of the process of introducing ambient water quality standards.
- CEA cannot physically monitor all water bodies spread out in the country.
- Schools in different districts can be used for this purpose of monitoring of water quality on a regular basis.

Conclusion

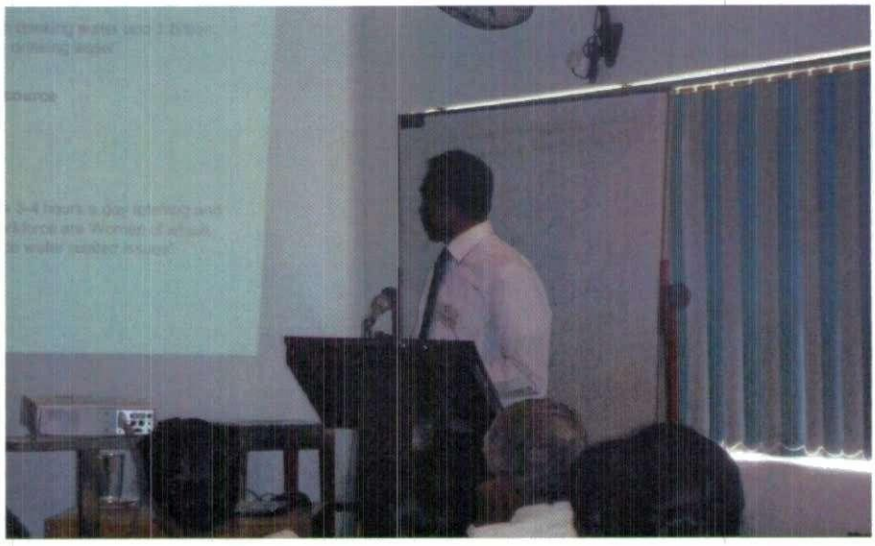
- In conclusion, water science education in schools is vital in order to ensure the quality of water bodies country wide.

ANNEX 1-5

Outreach Programmes and Concerns in Water Education in Schools – "From the Experience of Brandix Lanka"

ANNEX 1-5

Outreach programmes and concerns in water education in schools – "from the experience of Brandix Lanka"



Mr. Prasanna Wijewardane
Corporate Social Responsibility Division,
Brandix Lanka

Corporate Social Responsibility

Practices

in

Brandix

Brandix in Brief

The single largest apparel exporter in Sri Lanka

Contributing 1.4% to GDP,

employing 25,000 associates and generating indirect employment to an equivalent number

Supported by over 27 manufacturing facilities and strategically located Sourcing Offices

Providing over 50% of value addition locally through our backward-linked operations in textiles, thread, buttons, and hangers

Our CSR Focus

WATER

brandix

Water is life

Make every drop count

Why Water?

Water is Life

"5000 people a day die because of the unclean drinking water and 1 billion people have no access to safe drinking water"

An integral business resource

Women & Water

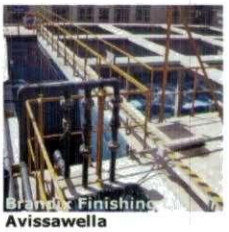
"An average village woman in NCP spends 3-4 hours a day fetching and storing water in dry season – 80% of our workforce are Women of which 60% are from rural communities who face water related issues"

Best Practices at Brandix

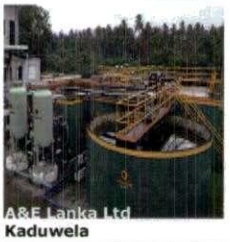
Concern for Water & Environment

Brandix Finishing Ltd
Ratmalana

Brandix Textiles Ltd
Panala



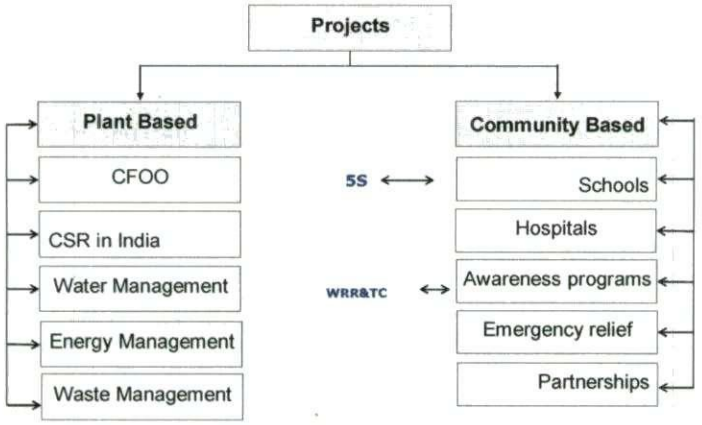
Brandix Finishing
Avissawella



A&E Lanka Ltd
Kaduwela

Quenby Lanka Ltd
Avissawella

Overview



CSR Projects at a Glance

Care for Our Own

H A S Ratnayake – BCW Seeduwa

M G Ramyalatha – BCW Seeduwa

Nadeeka – BCW Katunayake

CFOO Continue....

Tuder Prematthilaka - QLP

Nilusha Harshani – BIA Minuwangoda

N P Reeta – BIA Minuwangoda

Hospitals

Hettipola Hospital

A'Pura Kidney Hospital – Slow Sand Filter Project

Brandix in Partnerships

Brandix Deutsche Bank Project

2000 Florid filters distributed in NCP

UNHCR and Brandix join hands to assist Sri Lanka's Vulnerable communities

Brandix Community Outreach Projects

Bathing Station Project at IDP Camp Menic Farm

Kahawatta Community Water Point

Sanitary facilities for Disabled Children

Water Resources Research and Training Centre in Anuradhapura

25 in-house Training session and 18 on-site training programs completed to date

Schools

Why we selected schools

Children need six to eight glasses (1.5-2 litres) of fluid per day for (Kleiner, 1999).

When students are thirsty

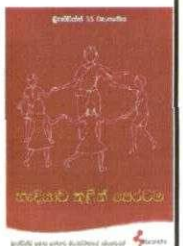
- mental performance deteriorates by 10%

How much children drink at school depends on

- the type and number of drinking facilities, their location
- how well maintained they are,
- how attractive the water supply and facilities are to children

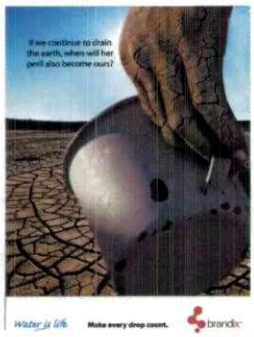
In Sri Lanka 2373 do not have drinking water facilities ,3658 schools do not have adequate sanitation facilities (school census of 2007)

Initiating 5S in Schools



Gajanayaka Vidyalaya won the National Productivity Award

Brandix Awareness Campaigns



Brandix Poster Campaigns on World Water Day

"For us,
Corporate Responsibility
is a
on going journey
not a
destination"

Thanks!

ANNEX 2

List of Participants

ANNEX 2

List of Participants

Name of Participant	Institution
Prof. Uma Coomaraswamy	
Mr. M.P. Vipulasena	Ministry of Education
Mrs. R.R. Ellepola	Central Environmental Authority
Ms. Anusha Alles	Brandix Lanka Limited
Prof. Ananda Gunatilaka	10, Thumbowila, Piliyandala
Dr. A.D.Ampitiyawatta	Fac. of Agricultural Sciences, Sabaragamuwa University of S.L.
Mrs. D.D. Premawathie	Co/Dudley Senanayake M.V. Park Road, Colombo 05
Ms. R. Chandralatha	Central College Piliyandala
Ms. A.G.P.W. Wimaladasa	Central College Piliyandala
Mrs. Kalyani Dasanayake	W.P./Kela/Ramasinghe Vidyalaya
Ms. Chethika Ambalangodage	Central Environmental Authority
Ms. T.W.A.W. Wijesinghe	Central Environmental Authority
Eng. Miss R.A.D. Jayanthie	Irrigation Department
Mr. Rohan Wijesooriya	National Water Supply & Drainage Board
Mrs. Sajeevika Perera	ITI
Mr. M.N.A. Mubarak	ITI
Mr. M.H.J.P. Gunarathna	Fac. of Agriculture, Rajarata University
Mr. C.M.R. Anthony	National Institute of Education
Mr. A.A.de Silva	National Institute of Education
Ms. S.M.C.G. Wijesekara	National Institute of Education

Mr. Shanaka Piyatissa	National Institute of Education
Ms. Harini Mapa Gunaratne	National Institute of Education
Prof. S.S. Wickramasinghe	Dept. of Civil Engineering, Univ. of Moratuwa
Ms. S.K. Ruwanpathirana	Taxila Central College, Horana
Ms. D.M.C.J. Disapa	Taxila Central College, Horana
Mrs. M. Jagapriyan	Hindu Ladies College
Ms. Jayani Sooriyapperuma	Nawala Janadhipathi Vidyalaya
Ms. S.M. Vishaka Samaraweera	Visaka Vidyalaya
Ms. U.L. Vineetha Pushpa Latha Perera	K/Gnanodaya M.V., Kalutara
Ms. A.A.W. Jayawickrama	WP/Kelal Ramasinghe Vidyalaya, Dalugama, Kelaniya

ANNEX 3

Seminar Photographs

Photo 1: Prof. Sirimalie Fernando/Chairperson NSF addressing the audience

Photo 2: Discussion continues among Group A members

Photo 3: Discussion continues among Group B members

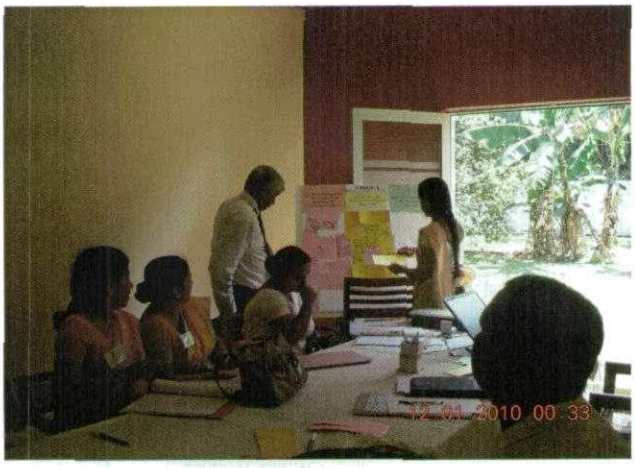


Photo 4: Discussion continues among Group C members

Photo 5: Presenting the recommendations by Group A

Photo 6: Presenting the recommendations by Group B

Photo 7: Presenting the recommendations by Group C

Photo 8: Vote of thanks by Dr. Sarath Abayawardana