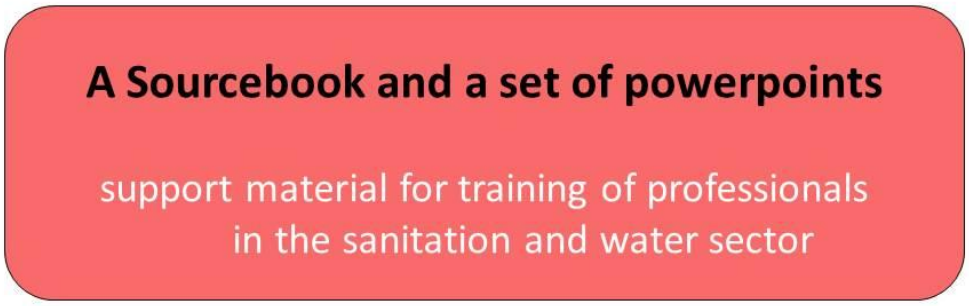
Sustainable Sanitation for the 21st Century



Linköping University · SLU Swedish University of Agricultural Sciences · Smi Swedish Institute for Communicable Disease Control · Vatema -capacity building consultant

Sanitation is multifaceted comprising hygiene, behaviour, engineering, planning, design, architecture, culture, social marketing, nutrient reuse, etc. Any training of professionals must aim at understanding all aspects in order to become an active player in implementing sustainable sanitation. There is a wealth of textbooks on the individual subjects. The present source book or learning material embodies the subject knowledge and aims to give a topic-based, integrated understanding of the intriguing sanitation challenges in different parts of the world.

The new need for sustainability that is resource saving and protection of human health and the environment requires innovation and rethinking. Sustainability cannot be achieved by ¨business as usual´ conventional methods. In our emerging consumer and chemical societies it will not be enough that residents pay for sanitation and water services – they have to be partners to make sanitation sustainable.

This learning material provides the TRAINER (researcher, teacher, instructor, mobilizer, etc.) with ready-to-use PowerPoint slides. Each slide has an explanatory text and references for more reading.

The slides are logically sequenced and can be used as a full academic course of 5–6 weeks. Also, it is easy to take out desired slides and combine them with your own material to fit your training plan. This flexibility is particularly important in formal training institutions where a syllabus steers training activities, and does not allow for major changes in the short term.

The training material will be updated as the authors gain new knowledge and more experience.

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Intro 2

Long-term sanitation challenges

- The urban population will double in the next 50 years
- Foreseen scarcity of water, energy, and nutrients
- Chemical society, emissions and global warming
- Manpower/capacity constraints

Learn from past experiences!

Jan-Olof Drangert, Linköping University, Sweden

Four factors will have a great impact in the near future; urban population growth, scarcity of natural resources, the increasing number of chemical compounds in all products we use and subsequent harmful emissions, and human capacity constraints such as poverty, a lack of access to information, conflict and lack of good governance.

Housing and feeding nine billion people instead of four or six billion puts enormous pressure on global resources, and all products which are used and then discarded put pressure on waste management systems. Fast-growing urban areas and mega-cities in the world become hot spots of used materials. Sustainable sanitation deals with what we do with used items; we may discharge them nearby (which affects only ourselves), further away (which affects others), or recycle them (which benefits all). On-going urbanization is both a challenge and an opportunity in this respect, since in cities there are more people to pay for joint solutions.

We foresee increasing scarcity of various resources: water, energy, and plant nutrients for food production. A major flaw of the conventional linear material flows is that resources are wasted. They also contribute to environmental degradation, which is severe in the chemical society we inhabit today. Waste streams of unprecedented volumes are produced – but also waste of unprecedented complexity. This calls for closing resource flows into loops with reuse of used resources. The sanitation sector can contribute to a sizeable reduction of environmental degradation, including global warming.

For the time being, the priority in the world seems to be on production and consumption of goods, and there is a serious shortage of manpower and capacity in the sector receiving all used materials. This situation is likely to persist, and therefore the next generation of products and systems must be benign by design, that is non-toxic and with re-use in mind. This is a major area for private sector contribution to improve sanitation conditions by producing environmentally friendly products and, at the same time, addressing scarcity and emission issues.

Past experiences can assist to make predictions about the future. Only then can we develop good policies and measures to guide us towards a sustainable society. Policies have more credibility when they are based on an understanding how we reached our present situation.

A holistic approach taking account of the above issues – and other relevant considerations – should guide the design of sanitation arrangements and long-term planning. This training material will provide up-to-date information from the scientific as well as the practical world that can enhance sanitation arrangements as well as improve the training of future professionals.

Objectives of the learning material

Intro 3

- To provide a cost-effective, up-to-date set of pedagogical slides with commentaries
- To serve as capacity building material
- To improve the quality of instruction
- To encourage students/participants to learn more about different aspects of sanitation
- To challenge learners to think 'out-of-the-box'

Jan-Olof Drangert, Linköping University, Sweden

The target group for the learning material comprises trainers at training institutions for professionals such as schools of public health, engineering departments of sanitation and water, agricultural universities, schools of architecture, university departments for social and economic sciences, etc. The material is similar to distance-learning material; it can be studied in a place and at a time the learner finds appropriate, the content can be studied partially or as a whole, and at a pace that the learner decides. Also, sections can be used for information and advocacy activities.

The material is composed of up-to-date information and knowledge, and is presented in a pedagogical format. Capacity building occurs when the trainee adds knowledge and skills to his or her existing repertoire. There are exercises to each chapter which are intended to stimulate the trainee to think through what he or she knows about the topic already, and what ideas and attitudes he or she entertains. The next step is to confront these ideas with the scientific and experience-based knowledge presented in the e-learning material.

There is a host of training materials on sanitation. Our ambition is to complement such material by integrating different topics in a way that is not normally done. In this way, the quality of instruction will improve and it will have a long-term impact on the trainee's attitudes and problem-solving skills.

The ***silent sanitation crisis*** is both indefensible and illogical. More than two-and-a-half billion people lack access to so-called safe sanitation and, as a result, 5,000 children under the age of five die every day. But strong words will not make this human health tragedy go away. The most important question remains the most simple: What can be done now? The scale and history of failure in the sanitation sector, and its deleterious impacts on development and the environment, would seem to justify a pessimistic outlook. Learning lessons from these failures, however, gives us reason for optimism. The training material draws on successful local activities and research. A lot more can and will be done to invest in and improve sanitation, health and hygiene in the 21st century.

No miracles are expected in the coming years, should we continue thinking in terms of linear resource flows in our homes and cities. The experiences of environmental damage caused by poor sanitation have increased our awareness. A strong political agenda in combination with emerging technical arrangements provides the realistic hope that individuals and communities can introduce feasible solutions. It is not only international organisations such as UNICEF, WHO and UNEP that are concerned about this issue. Recently, a high-ranking Vatican official, Archbishop Girotti, expressed the Church's concern over new sins and condemned "ecological" offences as modern evils (*The Mercury*, South Africa, 13/02/08).

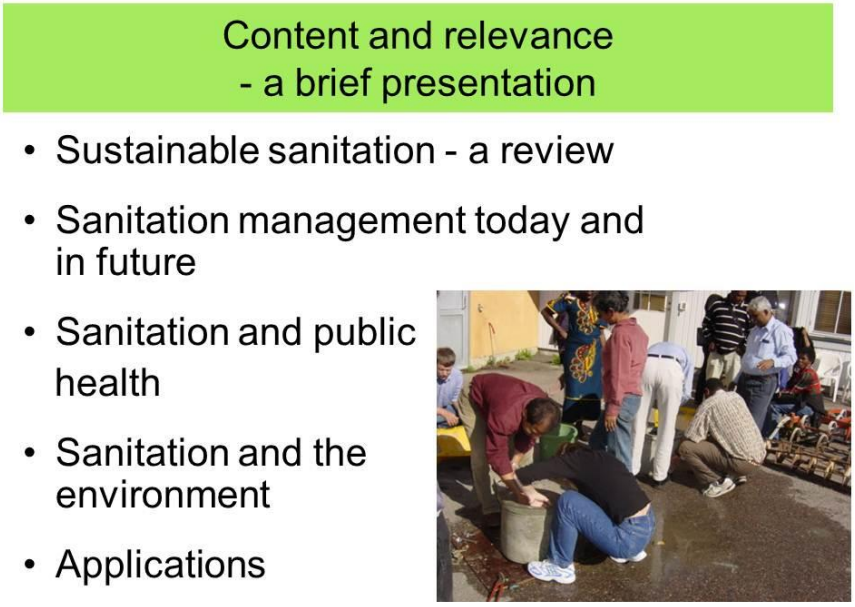
This PowerPoint material provides approaches to develop hands-on recommendations for what can be done in the short term as well as the long term. The information is easy to download and is free of charge.

The material is intended to encourage students to learn more about different aspects of sanitation. Such broader knowledge can help them avoid mistakes and inappropriate choices. For instance, instead of fitting a fly screen on top of a vent pipe (where it will corrode and not be replaced) a plastic fly trap (which is easy to monitor and replace) can be fitted. Another example is to build arrangements that will incur too high operational costs in a community with no system for providing the financial means to keep it going. One missing component may be enough for the whole system to collapse. A third common error is to install toilets in places where they tend to overflow during heavy rains.

The learning material also challenges the reader to think 'out-of-the-box'. For example, a sludge drying bed is viewed as an emitter of greenhouse gases, not only a method to reduce moisture. Residents are seen as real partners in development of sanitation arrangements. The current short term solution to alleviating hunger is to provide relief to starving people – rather than to change rules or conditions for farming. In this learning material we see food shortages as missed chances to direct nutrient flows in the sanitation sector to food production.

The Sourcebook and set of animated PowerPoint slides can fill the gap of knowledge and skills required to overcome the following five challenges for mankind:

1. There is **no water scarcity in cities**, only poor management of the available water
2. Future **toxic shocks can be avoided** through harnessing our chemical society by source control of products
3. **Food security** can be achieved through recycling of nutrients and changes in diets
4. **Morbidity can be reduced** through washing hands and safe handling of particularly child faeces
5. Households and **residents hold the key to improvements** mainly through improved sanitation routines, and also through exercising the power as consumers and voters



Intro 4

Jan-Olof Drangert, Linköping University, Sweden

Sustainable sanitation is an emerging dynamic topic for study. This e-learning material is not intended to be a manual or a set of directives. Rather, it aims to organise and illustrate approaches and tools which trainers as well as sanitation-sector practitioners and households may find useful.

It covers all aspects of sanitation: sanitation conditions, health and hygiene, agriculture and food production, recycling of nutrients and water, treatment methods, planning and design, technical issues and physical arrangements, socio-cultural issues, management, systems analysis, etc. Urban and periurban contexts are emphasised, since these are hot-spots of sanitation activities.

Each chapter focuses on one of the five main areas (the bullet points in the picture above) but is approached in a holistic way in order to emphasise the complex nature of sanitation. The challenge facing trainers is to prepare students and other trainees to think broadly when they try to develop sustainable sanitation systems. The task is no longer just to move waste products out of sight, but to develop management and physical arrangements to recycle waste material in a safe and productive manner.

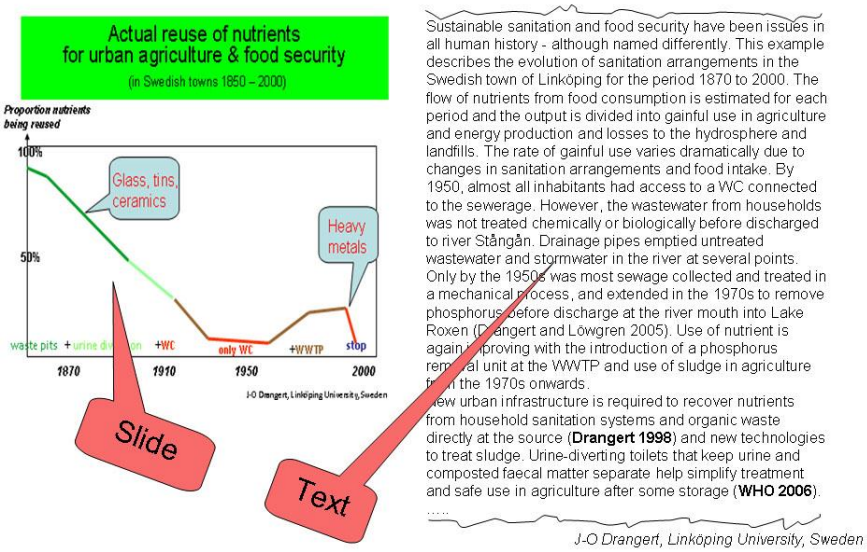
We discuss ways in which humans can manage their used materials, be it excreta or other organic matter, so that these do not cause unnecessary human health problems or environmental problems but rather become available for use. If these arrangements are successful, human health is protected and there will be no shortages of resources such as nutrients and water to secure food production.

We acknowledge that a lot is already being done by individuals as well as organisations. We view industry and the private sector as partners in sanitation in the same way as other bodies such as NGOs and authorities. Industry has the capacity, and is hopefully ready to develop, new viable ideas, products and systems. It may be more difficult to get monopolies such as municipal utilities and engineering companies interested in alternatives in sanitation.

This learning material has been gathered over several years of teaching at an international training programme called “Ecological Alternatives in Sanitation” (1999–2009) by the team from Linköping University, the Swedish University of Agricultural Sciences, and the Swedish Institute of Infectious Disease Control. Much of our understanding originates from discussions with the 300 participants in the international training programme from all over the world. Also, the participants’ individual professional projects have provided inspiration as has the training team’s work with the WHO Guidelines for sanitation (2006).

Guide to the user – the design of the material

Intro 5



The Sourcebook comprises an introduction and five chapters. Each chapter consists of a number of **Modules**. Each Module comprises a set of **PowerPoint-slides**, each one with a page or two of explanatory text.

Each slide is a pedagogical unit, often comprising a picture or diagram and some bullet points (left part of Intro 5). Some slides are animated so that the information gradually appears on clicking. More theoretical aspects are often illustrated in an effort to connect theories and methods to practical situations. The examples are drawn from various countries and time periods to impress upon the reader the varied conditions and also the similarities, which exist between countries.

There is an accompanying **explanatory text** (right part of Intro 5) to each slide in a separate pdf document called the **Sourcebook**, which the trainer can print out and keep as a guide. The text also includes references and proposed further readings on the topic.

The text box under each PowerPoint slide is empty so that the trainer can use it for his or her own comments.

Maneuvering in the sourcebook (pdf-file)

Links: The sourcebook contains blue-coloured underlined links to text references and slides within the present module. Use them in the following way:
Position the cursor over the link and ***click***. You are now transferred to the text reference or slide.
Return to previous page by pressing the Alt key and click left-arrow key ◄

Pages and bookmarks*:* There are two symbols in the upper left corner of the screen:

◄▪▪▪▪▪ *Click* here to open a panel for quick maneuvering between ***pages***.

◄▪▪▪▪▪ *Click* here to open a panel for quick maneuvering between ***bookmarks***.

As stated above, the links always connect to references or slides within the present module.

Readers who have downloaded a full chapter can come to other modules and slides within this **chapter** by clicking bookmarks.

Technical instructions are also found under "**Document Help**" in the home-page.

Guide to the user - methods

Intro 6

Sanitation today - and tomorrow

The green planet

Our planet is huge but has limited resources. Seen from space we can identify cultivated fertile areas as well as uninhabitable areas with sparse population. About half of the world's population live near to seas, lakes and rivers.

Had you seen the globe two hundred years ago, it would have looked very different. At that time the world population was 1 billion people, and today we are 6 billion. The then vast untouched areas were not affected by human activities, only by natural processes.

The six-fold increase in population is alarming in itself, but is aggravated by the fact that each person consumes ever more. In the last century population has tripled, water use has increased six-fold, and the extraction of natural resources 12-fold. World Watch Institute estimated that *if* every Chinese were to eat an egg daily, the required cultivated land to feed the hens would be as large as Australia's total farmland.

It is in this perspective that recirculation and reuse has come to the fore. Food and consumer goods all end up somewhere after use. Sustainable sanitation connects the use and disposal of products to production of new products.

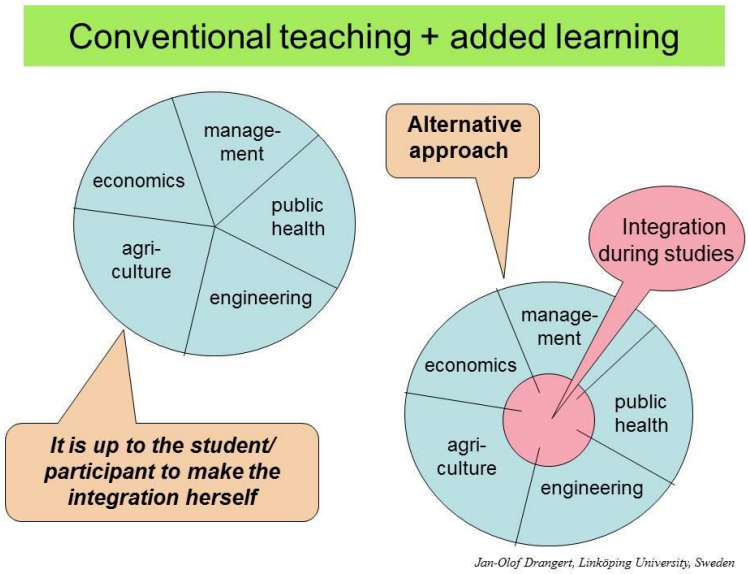
Learning objective: to understand prevailing sanitation conditions in various corners of the world.

Discuss your thoughts with colleagues/peers and **identify some research questions** you would like to investigate. **Write** down for your own record what you already know or think about this issue, and what you would like to know more about – before you continue to read.

J-O Drangert, Linköping University, Sweden

Each chapter has an exercise intended to create interest in the topic, and to stimulate the learner to think through what he or she already knows and how they perceive the situation. The exercise may be used by the trainer or facilitator in groups, where learners are discussing the issue. The format is inspired by the problem-based learning methodology (Study Guides and Strategies, 2010; http://www.studygs.net/pbl.htm). Sanitation is a very good topic for PBL since most problems are related and can usually be addressed using a variety of technical and management options.

Ideally, a training session stimulates participants to take responsibility for their learning process through their own activities. Problem-based learning (PBL) emphasizes that each participant learns from peer knowledge and experiences. Discussions and problem-solving in small groups stimulates participants to become responsible for their own learning process, and the facilitator's job is to formulate the learning goals and come up with interesting cases. Lectures ideally serve as a support to address the questions and problems that the small-group discussions lead to. The idea is to give answers and contexts after the questions have been raised, not to give an answer before the learner has formulated the question. This methodology is attractive and feasible for participants who already work in the sanitation sector and could share their experiences and knowledge with peers from other sectors. This is the essence of the aim of inter-sectorial understanding.



The hallmark of a competent professional is that she can combine pieces of knowledge, experiences and skills into a holistic view of the situation. It takes time and effort to reach such maturity, and any basic training programme should aim to instil such maturity.

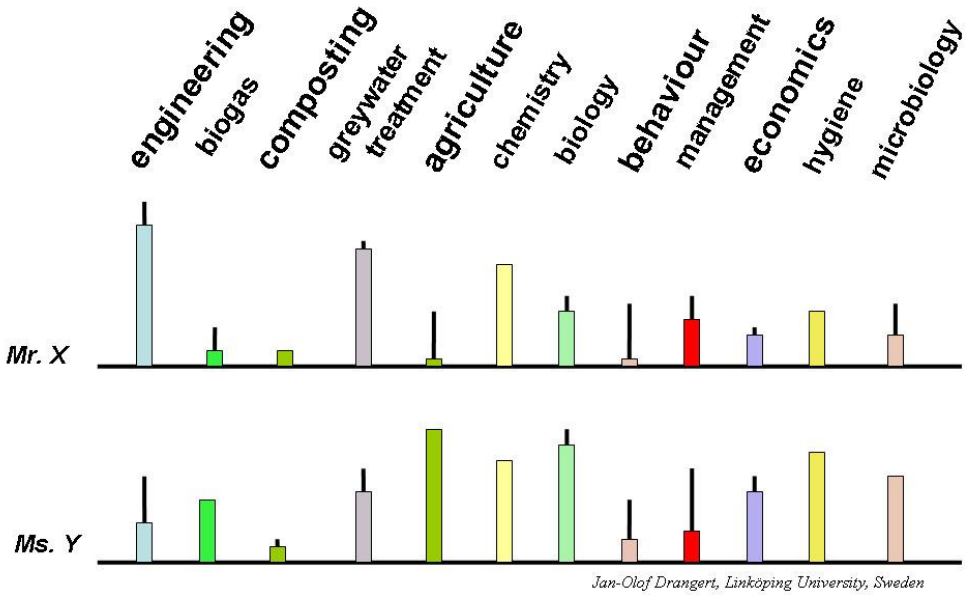
Due to competition and time constraints most institutionalised training programmes tend to deal with separate facets of each subject and leave the integrative task to the students (left picture). This approach represents a lost opportunity for working towards a joint training goal. A training schedule or syllabus should make provision for integrative activities (right picture) where the student is trained under the supervision of an experienced instructor.

There are several practical ways to provide such training activities: (i) Students can work on **case studies** which are designed to require knowledge about various subjects if they are to be solved satisfactorily. (ii) Students can conduct **interviews** with persons who are managing complex situations in order to find out how such people think and act. (iii) Student may also make well-prepared **study visits** to places where they can experience integration aspects in an real-life situation.

A study visit can serve as a skills training session in observation and interviewing. Here is an example: During the study visit, while the participants look around, the facilitator takes strategic photographs and collects oral information from local guides and others. A day later, a few strategic pictures serve as a starting point for detailed discussions about what the participants saw and heard during the visit. The participants are asked to tell what they see in each picture and how they understand the situation. Typically, the start of the session is slow, and only gradually do they come forward with their comments. They should not be rushed, however, because that would deprive them of the chance to learn. After a while they realise that they have each seen very different things, and they have not made the same mental connections and interpretations of the situation. At this stage they become eager to understand how things are connected and they try to relate the findings to what has been discussed in various subject courses. A frequent evaluation comment from participants is that they had seen and heard very little during the visit. They add that they benefited a lot more through this review exercise and it made the study visit worthwhile and productive. In this way they are trained to become observant and make full use of the visit. The discussion also serves the purpose of getting the students to apply what they have learnt earlier in the course and now have to apply in a real-life context. This proves to be an effective way of reviewing the major points in the training. Such an exercise to discuss around the pictures takes at least as long as the study visit itself! It proves to be well spent time.

Knowledge development through peer learning

Intro 8



A lone professional cannot cover all aspects of sanitation, but a team of specialists can. Work in a team is beneficial if each member is sufficiently familiar with the others' areas of competence. Familiarity means knowing enough to be confident to ask questions, to exchange ideas and to negotiate about the system under consideration.

The above picture depicts the knowledge-level profiles of a number of subjects connected to sanitation issues. If two people together take on a task, they complement one another (picture). The result will be that they learn from each other (black lines). This learning from a peer is closely related to a problem-solving activity and therefore tends to be well understood. Research has also shown that it is easier for a person to admit and adjust preconceived ideas in a group of peers than in a formal training situation. One reason is that they are more engaged in a discussion in the group and have a chance to test their own ideas and also to listen to peer arguments for and against. Such a change in perception can be done without loss of face.

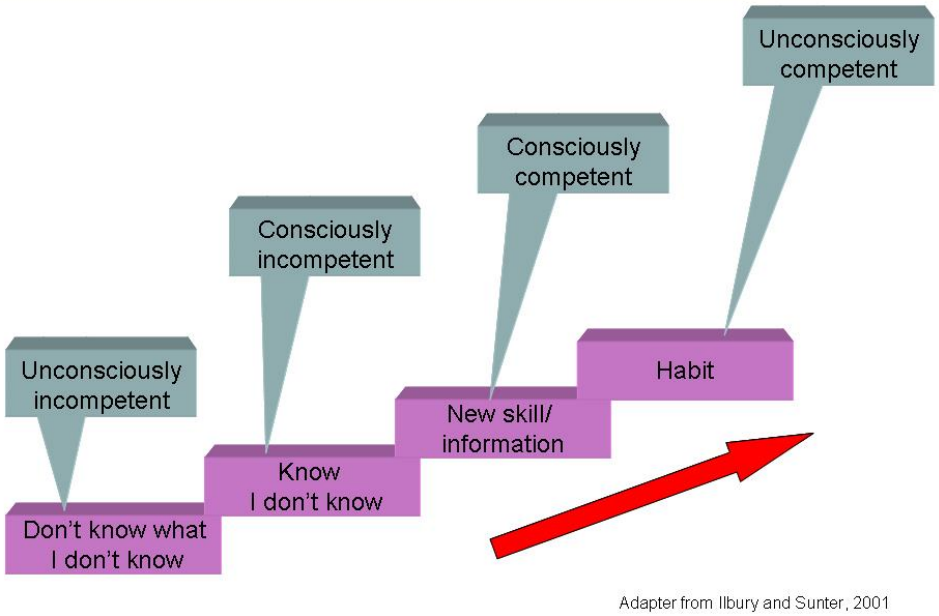
The present material is designed to encourage students to learn from each other. Communication skills are important for learning from peers to take place and, more generally, is a fundamental attribute of any change agent. This is facilitated if the syllabus or study programme also contains a section on interview skills training. An example of a training format is as follows. Each participant conducts a mock interview in front of a video camera, and a professional communication expert assists the group (of four trainees) to observe and comment on each trainee's performance. The tape is then replayed to find out to what extent the first impressions and comments are valid. Each participant later conducts real-life interviews for which they select a topic and prepare questions that will enable them to get in-depth answers during the interview. The task of producing an interview protocol commonly requires detailed guidance (Boot and Cairncross, 1993; Iarossi, G. 2006).

Finally, they present their interview results to the group and in this way each participant gains more information/knowledge than could be collected by a single person.

An interview training session provides the opportunity to become conscious of the impact of one's own behaviour as interviewer and as a member of a working group. Such a skill will be readily applicable in their future work, not least when conducting surveys and studies about residents' perceptions and values. The training could help trainees to avoid some common mistakes when they approach respondents and formulate questionnaires. Respect and good rapport with respondents and peers is a must that is often overlooked.

Life-long learning: climbing a competence ladder

Intro 9



Fortunately, there is no end to learning and we learn all our lives. Our social and physical environment changes more or less regularly and we strive to become competent in new situations. The competence ladder (picture) indicates the steps we have to climb over and over again to adapt to or control new situations. In most situations these steps are taken on the initiative of the individual to solve an immediate need. The individual typically searches for the required knowledge and information from friends, peers, written material etc., and nowadays also on the internet and other social media.

Formal training programmes can offer the students more long-term fulfilment of needs such as a certificate that in turn will open up new job opportunities or be a step in their career. In our case, however, a trainer cannot rely on students having an immediate interest in learning each topic. The trainer has to create a learning environment that inspires the students to search for the knowledge and skills that are required. Fortunately, the trainer can rely on the inbuilt human desire to understand and to feel competent. The learning should be a win-win situation for the student and the university.

This training material aspires to provide a programme that can be used to inspire students to want to understand the various issues pertaining to sustainable sanitation.

Chapter 1. Sustainable sanitation – a review

Intro 10

	Questions	Learning objectives
Module 1.1 **Sanitary conditions in the world**	How do we perceive sanitary conditions? What functions must a sustainable system fulfil?	To become familiar with various sanitary conditions in the world, functions of sanitation, and to foster a critical understanding of statistics and other data.
Module 1.2 **Resources**	Where are the resources? What might be the problem to access them?	To familiarise with a coordinated view on resources, and to understand the context and role of sanitation.
Module 1.3 **Resource flows**	From where do resources come and where do they end up?	How resource flows are created and manipulated. Methods to analyse flows.
Module 1.4 **Demographic change**	Is urbanisation a solution or a problem for improving sanitation?	To gain insights about the role of demography in sanitation, planning and implementation.

Jan-Olof Drangert, Linköping University, Sweden

Chapter 1 gives an overview of sanitation in the world and elaborates on its connections to other sectors, mainly agriculture, energy, manufacturing, and natural and human resources.

Improved sanitation can reduce global warming as well as scarcity of resources such as nutrients, water and energy.

Chapter 2. Sanitation management today and in future

Intro 11

	Questions	Learning objectives
Module 2.1. **Sanitation arrangements**	Is there one system that suits most conditions or must we choose and combine?	Matching management with technology and local conditions.
Module 2.2. **Major changes over time**	How does consumption and habitation patterns impact reuse? What footprints are left?	Gradual long-term changes in sanitation arrangements and tracing origins of change.
Module 2.3. **From policy to action**	Who should decide what is permitted? Do polluters really pay?	Regulations and how to interpret and translate them to local action and change.
Module 2.4. **User perspectives**	What are residents appreciating? Why?	Be sensitized to variations in attitudes and norms.
Module 2.5 **A way forward**	How to obtain all the information we need?	Selecting a sustainable arrangement is more than just choosing between technical solutions
Module 2.6 **Plans and design** - points to consider.	Planning and design - does it make any difference if they are good or bad?	To appreciate the possibilities offered by nature to facilitate easy use and operation of household sanitation arrangements.
Module 2.7 **Construction and monitoring**	What bottlenecks are there for councils and residents? Are there ways to go about it?	The paramount role of *good* construction for *smooth* operation. How to raise ambitions without stretching council capacity.

Jan-Olof Drangert, Linköping University, Sweden

This chapter deals with the interface between humans and physical arrangements. Several examples are presented to show the many options available to reach towards sustainable sanitation.

Chapter 3. Sanitation and public health

Intro 12

	Questions	Learning objectives
Module 3.1 **Exposure and effects in humans**	How are infectious diseases transmitted? What happens when people are exposed to pathogens?	To become familiar with the most important pathogens found in water and sanitation systems, with the symptoms they cause and with their effect on individuals and populations
Module 3.2 **Environmental transmission of pathogens**	Where do the pathogens come from? How do pathogens in excreta contaminate the environment?	To become familiar with environmental transmission routes for pathogens, especially in relation to water and sanitation.
Module 3.3 **Pathogen reduction**	How persistent are pathogens in the environment? How can we prevent exposure and disease transmission in sanitation systems?	To become familiar with the behaviour of pathogens in the environment and the effects of treatment and strategies for minimizing the transmission of disease, esp. in relation to agricultural use of excreta.
Module 3.4 **Health targets**	Which targets can be achieved in relation to exposure and treatment? How are barriers used in guidelines to minimize health risks?	To become familiar with faecal indicators and the risk concept, and to understand their application in guidelines for reuse of excreta and greywater.
Module 3.5 **Risk management**	Can we measure a risk of disease transmission? How can sanitation systems be evaluated?	To be aware of how the potential health impacts of sanitation systems can be evaluated and compared regarding their potential health impact.

Caroline Schönning, Swedish Institute for Communicable Disease Control, Solna, Sweden

Chapter 4. Sanitation and the environment

Intro 13

	Questions	Learning objectives
Module 4.1 **Cycles and flows of plant nutrients**	How do plant nutrients and water flow in nature? How have these flows been altered by Man?	To be familiar with cycles of plant nutrients in nature and how various sanitation systems affect these cycles.
Module 4.2 **Treatment of excreta for safe reuse**	Is it safe to use treated faecal matter in the garden?	How to treat urine and faeces for safe handling and reuse in crop cultivation. Co-treatment of organic materials from households.
Module 4.3 **Compost treatment**	What happens in a compost? How is the material degraded and what are the end products like?	Composting as a biological treatment of organic waste. Processes and the function of the system.
Module 4.4 **Biogas– a way to solve sanitation problems.**	How much biogas can be produced from excreta and biomass? How safe is the process and its sludge?	To understand the fundamental processes in biogas production, and get an overview of biogas generation in the world.

Björn Vinnerås Swedish University of Agricultural Sciences, Jan-Olof Drangert, Linköping University, Sweden

Chapter 4 cont. Sanitation and the environment

Intro 14

	Questions	Learning objectives
Module 4.5 **Greywater is man-made**	Greywater as a resource? What happens with used household chemicals?	The role of households in tackling environmental and resource challenges
Module 4.6 **Greywater – processes**	What compounds can be removed? How can Nature assist or react?	To become familiar with basics of various physical, chemical and biological processes.
Module 4.7 **Greywater treatment**	Can we remove all the pathogens and heavy metals? What is in the sludge?	Get familiar with various treatment options and with the application of various processes
Module 4.8 **Excreta fertilisers in agriculture**	How can ecological fertilisers from excreta best be used?	Factors limiting yield. Functions of plant nutrients. Examples and recommendations.
Module 4.9 **Environmental systems analysis**	Can sanitation systems be compared fairly? How to measure impacts?	System boundaries. Quantification of environmental effects and resource use.
Module 4.10 **Comparisons of sanitation systems**	How can a dry urine diverting toilet system be compared with a conventional system?	Effects on water, climate and various resource use. Cost-benefit analysis.

Björn Vinnerås Swedish University of Agricultural Sciences, Jan-Olof Drangert, Linköping University, Sweden

Chapter 5 Applications: Sanitation in practice

Intro 15

	Questions	Learning objectives
Module 5.1 **Phosphorus – Food security & food for thought**	Should we worry about phosphorus? Are there substitutes for plant nutrients?	Phosphorus as a resource, and its links to sanitation and to food security.
Module 5.2 **Public toilets**	Can public toilets be made attractive? Can vandalism be avoided?	How to plan and implement sustainable toilets in public places.
Module 5.3 **School toilets**	Can schools inspire good hygiene and promote eco-sanitation?	To get acquainted with the special management and construction needs of school toilets.

Jan-Olof Drangert, Linköping University, Sweden

Web pages and other information material

Intro 16

- Rapidly growing number of web-sites with info on sanitation issues
- Broad information on sanitation activities in the whole world

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It is becoming difficult to navigate and evaluate sanitation information due to the explosion in web-sites and written materials. The team of authors of the present learning material has screened available resources and tried to identify scientifically sound material and included it in the lists of references and recommended additional learning materials.

Research and guidelines:

A wide range of research papers about hygiene, risk assessment, treatment methods, sociocultural conditions, planning, reuse, flow analysis etc. are referred to in the text. Also, guidelines from national agencies and international organisations such as WHO (2006) Guidelines for reuse of urine, greywater and faecal matter are referred to.

- **Compendium of Sanitation Systems and Technologies**

http://www.eawag.ch/forschung/sandec/publikationen/compendium_e/index_EN

- **Microbial Exposure and Health Assessments in Sanitation Technologies and Systems**

http://www.sei-international.org/mediamanager/documents/Publications/SEI-Report-Stenstrom-MicrobialExposureAndHealthAssessmentsInSanitationTechnologiesAndSystems-2011.pdf

CD-based information (every international organisation publishes their material on a CD):

"An ecological approach to sanitation in Africa" by Peter Morgan, Harare-Zimbabwe

"Water & Cities" by UN-HABITAT for the 3rd World Water Forum

"State of the cities report 2004" by South African Cities network

"Fire and water/A healthy city for all/Trail of two cities" by City of Cape Town

"A new governance from below. Cape Town, South Africa" by Slum Dwellers International

"Beyond the track. Mumbai India" by Slum Dwellers International.

"Will push come to shove? Old Fadama, Accra, Ghana" by Slum Dwellers International

"All in the name of development. Kibera, Nairobi, Kenya" by Slum Dwellers International

"Middle East and Mediterranean regional day" by the World Bank

"A journey in the history of water" by Watervideo.com

"Introduction to a legal framework to pollution management" by Deloitte&Touche, WRC

"Best practices of water & waste water management in Kathmandu" Action Aid-Nepal

"Management report 2003" by ANA= National Water Agency, Brasilia-Brazil

"Water demand management" by IUCN and Sida IDRC

"Wastewater management and public-private partnership" Japan Sewerage Com for 3rd WWF

"Guidelines for management of sewerage facilities in DC" Japanese Gov, Infrastructure Dev

"Working towards unlocking the water potential of agriculture" by FAO, Rome

"The state of the world's children 2005. Childhood under threat" by UNICEF

Films (browse the organisation´s web site):

"Human excreta index" by Waste-Holland

"Lesser humans" by Navsarjan Trust, Ahmadabad-India

"A journey in the history of water"

"Casting a cement UD-toilet" by Espacio de Salud-Mexico

"How to use and look after/change vaults/empty UD-toilet" by Ethikweni City-South Africa

"Sulabh sanitation movement" by Sulabh International, New Delhi-India

"Enviro options" by Enviro loo, South Africa

"The del Agua kit" by Robens Institute, Surrey-UK

Utube: http://www.youtube.com/watch?v=XgKCfuKPE6s

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Intro 17

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