

Capacity building at lower cost: conducting an online course on Ecological Sanitation

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Abstract

The concept of ecological sanitation is expected to play an increasing role in the quest to meet the Millennium Development Goal's target on sanitation by 2015, which currently seems near impossible to still achieve on time. Due to the increased worldwide interest in ecosan and an existing lack of capacity, there is an urgent need to train a large number of professionals in many different countries quickly. With online learning this can be achieved due to its minimised travel needs and lower costs. This paper describes the rationale for developing an online course on ecosan for mid-career professionals who work in developing countries (course duration of 16 weeks in part-time mode, equivalent to three weeks face-to-face training, at a course fee of € 550 per student compared to an equivalent face-to-face short course in Delft at a cost of approx. € 4,100 per student).

The paper also discusses advantages and disadvantages of this course compared to face-to-face teaching, our underlying pedagogical concept (emphasising two-way iterative dialogue and interactivity between students and teacher), the course structure, the course components which cater for different learning styles, the 'I-Learning Environment' used, the required activities of the students and teacher, and student feedback from the first batch of 25 students from all over the world. The results show that the students valued in particular the quality of the course material, the variety in participants' background and the regular discussion contributions of their fellow classmates on the asynchronous discussion forum (the participants came from countries as diverse as e.g. Rwanda, Zambia, Nigeria, Bhutan, Sri Lanka, Peru, Australia and Bulgaria).

We believe that low-cost online courses on ecosan or similar topics have great potential for capacity building in the future, since fast internet access will continue to spread in developing countries, and the need to reduce carbon dioxide emissions from air travel will become more and more evident to reduce the magnitude of global climate change.

Keywords ecosan, e-learning, developing countries, Millennium Development Goals, iterative dialogue, e-tivity.

Introduction

The MDG target on sanitation (Goal 7, Target 10) will not be met unless major efforts are made between now and 2015 (UN, 2007). The year 2008 will be the UN Year of Sanitation in order to raise awareness for the importance of sanitation. Ecological sanitation is an alternative approach to sanitation that recognises human excreta and greywater from households as resources rather than as wastes. These resources can be collected, treated and safely used again.

The ecological sanitation (or ecosan in short) concept is nowadays gaining increased recognition and momentum (e.g. WHO, 2006). As a result, there is an emerging need for large-scale capacity building to equip professionals with the knowledge and skills to plan, implement and maintain ecosan systems (in all their different applications, sizes and technologies used). A similar problem exists in other emerging cross-cutting topic areas, such as climate change and renewable energies, or even just with educating primary school teachers in developing countries to meet the MDG number 2 on universal primary education, where a large number of professionals need to be trained quickly as well.

In order to effectively and cheaply train many professionals in ecosan, we advocate the use of online learning which can inherently include a train-the-trainer approach (the material which the participants receive in the training or education setting should be in a format that they can easily adapt to their own teaching needs).

Online learning (also called e-learning, web-based learning, distance learning) is a modern form of the traditional distance learning by correspondence with the emphasis on using latest didactical methods for adult learners (e.g. student-centred learning) and use of modern information technology. For a subject such as ecosan, online learning in a group of peers (with support by the teacher or facilitator/tutor) is more beneficial than online learning by self-study due to the multi-disciplinary nature of the ecosan concept: discussions and exchanges of ideas between participants from different countries, cultural backgrounds and professions are crucial to maximise the learning experience.

The target audience of the ecosan course described in this paper is mid-career professionals who work in low-income countries or countries in transition, and deal with planning, promoting, designing, operating or managing sanitation systems for people in urban, peri-urban, slum or rural areas. Participants are typically employed by government departments, private companies, NGOs, universities, research institutions, aid agencies or international bodies such as WHO or UNICEF.

This paper describes our rationale for developing an online ecosan course for the target audience as mentioned above, our methodology and observations after the first batch of students has completed the course. The course ran for the first time from 1 March to 21 June 2007 with 25 participants who came from 19 different countries (Nigeria, Rwanda, Zambia, Ethiopia, Philippines, Sri Lanka, Bangladesh, Bhutan, Indonesia, Brazil, Peru, Australia, Germany, Italy, Spain, UK, Portugal, Bulgaria and the Netherlands). In the future, the course will run twice per year.

With this paper, we want to encourage other colleagues who are involved in capacity building on ecosan or related subjects to consider online teaching as a viable addition or alternative to the traditional face-to-face teaching.

Rationale and limitations for online course versus face-to-face course

Our main driver for conducting this and future ecosan online courses was to reach a large number of people all over the world at lower cost compared to the traditional face-to-face teaching. The advantages of teaching about ecosan in a part-time online course (140 hours study load spread over 16 weeks) rather than an intensive 3-week face-to-face course include:

- **Lower cost:** At UNESCO-IHE, the course fee for a 3-week residential short course is €2040 in 2007. In addition to this, the student has to cover the return flight to Delft as well as accommodation and living expenses for three weeks. The total amount per student is therefore in the order of €4100 (assuming a flight of €650 and daily allowance of €75 for 19 days). Of course alternative models of delivery exist (e.g. teaching in the participant's country – so the teacher travels instead of the students). The course fee for an online course on the other hand is only €550 and there are no additional fees for travel, accommodation or living expenses. Clearly, online teaching is much cheaper for the students, and it means that for the same amount of money, more students can be trained than by using (highly specialised) face-to-face courses.
- **Better material:** From our own experience, the material used for our online courses is often of better quality than the material used for classroom teaching. The level of scrutiny is higher when the material is placed on the internet: for example, powerpoint slides with photos need to be in stand-alone format, because the lecturer cannot give additional verbal information. Also the material has to be more clearly structured, because the student's learning process is more self-directed. As a side benefit, we have now made all the course material permanently available via the ecosan online course demo version (www.lms.ihe.nl with login: ecosandemo and password: 1234).
- **Lower CO₂ emissions:** If either the student or the teacher has to travel for specialist training or education at MSc level, there will in most cases be a need for air travel and causing carbon

dioxide emissions which contribute to global climate change. With an online course, nobody has to travel and therefore no additional travel-related emissions are caused.

- **Easier to run course in part-time mode:** Online courses are commonly delivered in part-time mode, whereas a face-to-face course can only be given in part-time mode if participants live in the same city where the teaching takes place. Advantages of this part-time mode (e.g. with a study load of 9 hours per week) include:
 - It allows the student more time for reflection and for the course material to ‘sink in’.
 - It is easier to combine work with studying, and there are more possibilities to directly apply the knowledge gained in the daily work and to share it with work colleagues.
 - It is easier to combine studying with being a parent - something that is particularly (unfortunately) important for female participants.
- **More flexible for student-centred curriculum and for lifelong learning:** In a contemporary educational vision students should no longer be confronted with a ‘pre-cooked’ curriculum, but they should be challenged to choose their own curriculum. This implies making the possible sequences and combination of modules more flexible, which can be easier done with online learning than with face-to-face learning. Also, online courses can be one of the vehicles for lifelong learning, whereby employees can continually update their knowledge and skills without having to interrupt their careers.

UNESCO-IHE began offering online courses in March 2005 and currently has 11 online courses on offer, covering a broad range of water-related topics. Eight of these online courses were developed in 2004 in the context of the PoWER programme (Partnership for Water Education and Research) with additional funding of the Dutch Ministry of Public Works, Transport and Water Management with a budget of about € 60,000 per course.

Given our experiences in developing online courses, the upfront investment needed for the online ecosan course was much lower – around € 15,000 (for converting existing course material into the online course format and adding some new objects, e.g. the voice recordings). The income from the course fees is used for the teacher’s time to carry out the activities shown in Table 5 (i.e. mostly the interactions with the students), time to improve and update the course material and for UNESCO-IHE’s related administrative costs and overheads.

The limitations associated with an ecosan online course compared to a course delivered in face-to-face mode are listed in Table 1 and Table 2.

Table 1. Limitations of an ecosan online course (compared to face-to-face teaching) affecting mainly the *teacher* (and indirectly the students as well), and strategies used to overcome these.

Observed limitation / disadvantage / problem	Strategy to overcome limitation
Teacher receives no feedback via the body language of the students, so it is difficult to know if students are bored or excited by the material. Also the teacher cannot directly check if a quiet student (no postings on discussion forum) is quiet but reading actively, or is quiet because he/she has lost interest.	<ul style="list-style-type: none"> • Frequent use of detailed questionnaires to obtain feedback (in our case: at the end of each unit, i.e. every week or every second week). • The teacher can send direct e-mails (or make a phone call) to quiet students enquiring about their reasons for not posting.
Teacher should check e-mails and new discussion postings daily. Also the teacher cannot go on holidays or longer work trips during the 16 week course period.	The teacher can reduce his/her workload by employing a tutor who can answer any basic queries, and alert the teacher to more difficult questions. The teacher can also try to check e-mails and the discussion postings during holidays or work trips (this works from any computer with internet access).
Use of guest lecturers may be more difficult than in face-to-face courses (it is harder for the guest lecturer, who is only involved during a short time span, to establish a rapport with the students).	Give the guest lecturer as much information about the methods of online teaching and the background of the students as possible. Over time, guest lecturers will also develop some experience in online teaching.

Table 2. Limitations of ecosan online course (compared to face-to-face teaching) affecting mainly the *student* (and indirectly the teacher as well), and strategies used to overcome these.

Observed limitation / disadvantage / problem	Strategy to overcome limitation
Many students from developing countries still struggle with slow or unreliable internet connections, resulting in a disability to download large files and sometimes not watch videos over the internet.	<ul style="list-style-type: none"> • Limit maximum file size to 10 MB per file • Provide course DVD with all materials upfront. • Discourage students from participating if their internet connection is unreliable (the downside of this approach is that it may exclude students from very poor countries).
It can be difficult to balance the workload between a full-time job and an online course (whereas when taking a residential full-time course, there are fewer distractions from the student's job and family).	<ul style="list-style-type: none"> • Teacher has to help students with time management (e.g. regular reminders; strict schedule) • Make it clear to prospective participants what the expected weekly course workload is.
Students who are not good at writing or typing or have poor English language skills are disadvantaged during discussions or written assignments.	During selection process, observe student's ability to write well and make it a selection criterion. Assignments can also include less writing (e.g. having to make a poster, a voice recording, so-called mind maps or concept maps, etc.).
Students who learn best from listening, rather than reading, are disadvantaged and may not enjoy the online course.	Supply many audio files (voice messages) and video clips.
It is harder for the students to form friendships with each other and to establish a network.	<ul style="list-style-type: none"> • Encourage students to work together, e.g. by doing assignments in 'buddy pairs'. • Have a discussion topic running throughout the course where people can post information about their lives outside the course. • Ensure each student uploads a picture of himself or herself into the student profile section. • Sometimes students have the opportunity to meet in person, particularly if they are from the same country. • Students can continue as an online community, e.g. as part of the global ecosan discussion forum hosted by the Swedish organisation Stockholm Environment Institute / EcosanRes.
There is no opportunity to travel away from home country, which can be an enjoyable experience.	<ul style="list-style-type: none"> • Having discussions with classmates from all over the world partly makes up for this disadvantage. • At least no travel means also no travel-related CO₂ emissions, so that is actually an advantage.
There is no possibility for field trips.	Use video footage as much as possible.
The online courses at UNESCO-IHE are currently not accredited but the students receive only a 'certificate of attendance'.	UNESCO-IHE is working on obtaining accreditation for its online courses in the future.
The course fee of 'only' € 550 is still a barrier for people from low-income countries. The Dutch fellowship organisation Nuffic, which provides fellowships for the expensive face-to-face courses, provides at present no fellowships for the much cheaper online courses.	We are regularly acquiring scholarships from various sources, e.g. from Stockholm Environment Institute and various Dutch and German companies in the water sector which are active in the ecosan field.

Description of the course

Pedagogical background and importance of the discussion forum

University lecturers who teach science and engineering subjects rarely have a background in pedagogy, and have little theoretical knowledge on how to teach adult learners, let alone how to teach by using the internet. At the present time, the pedagogy for online teaching is less well understood and less intuitive than for face-to-face teaching.

An influential learning theory, which our online teaching is inspired by, is the learning theory described in Laurillard (2002). This theory is based on phenomenographic studies and ‘Conversation Theory’. In Laurillard’s view the learning process must be designed ‘to elicit awareness of inconsistencies in conception, variation in conception’, and there must be ‘a continuing iterative dialogue between teacher and students, which reveals the participants’ conceptions, and the variations between them, and these in turn will determine the focus for the further dialogue’ (Laurillard, 2002).

The Conversational Framework of Laurillard (2002) emphasises the importance of dialogue for effective academic learning. The nature of much academic learning is largely defined by the acquisition of complex concepts, but acquisition of those concepts cannot be achieved by a pedagogy based around a one-way presentation of content. The only way to achieve this is a two-way iterative dialogue between teacher and student at the level of conceptions until the individual student reaches an adequate grasp of the concept.

In line with this idea, Salmon (2002) advocates the use of ‘e-tivities’ as an online replacement for generating interactivity. An e-tivity is essentially a group discussion on an asynchronous discussion platform in which students are stimulated to share experiences, concepts and feelings about a topic. While doing this, they will practise formulating, article writing and taking a standpoint.

We also took this approach here, and made ample use of the discussion forum in our I-Learning Environment, which became the ‘heart and soul’ of the course: The discussion forum is the place where the iterative dialogue between teacher and student, the cooperative learning, the online cooperation and interaction takes place. This is also the reason why we did not make this course a self-study course: we wanted the students to go through the course at the same pace so that they can cooperate and interact in a meaningful way with each other and with the teacher.

The discussion forum was used in a number of ways, all of which aimed to generate students’ interactivity (see also Table 5). Examples for ‘Small Tasks’ (or ‘e-tivities’) used are shown in Box 3. Being active on the discussion forum was also part of the requirements for obtaining the course certificate (see Table 2).

As can be seen in the section ‘Student Feedback’ below, the students highly appreciated the discussion forum. Examples of discussion topics started by the students are listed below:

- “Ecosan: Paradigm shift or passing fad?”
- “Water and sanitation privatisation – good or bad or both?”
- “Role of government in sanitation provision”
- “Adult vs. children faeces – which is more dangerous?”
- “Merits and demerits of online education/training”

Box 3. Examples of Small Tasks (e-tivities) used on discussion forum

Small Task 7: Linkages between mainstreaming HIV or AIDS and ecosan in your country

Please describe your thoughts on what could be done to break the silence around HIV or AIDS in your country, how it could be ‘mainstreamed’ (what is your understanding of mainstreaming HIV and/or AIDS) and what connections you see to sanitation in general or ecosan in particular. If you come from a country where AIDS is not so prevalent (e.g. Portugal), you could still describe the situation there, or pick another country that you know well.

Small Task 10: What can you tell us about the practice of rainwater harvesting in your country?

- How much rainwater harvesting is being practiced in your country (as far as you know of)?
- Have you ever tried doing it yourself (collecting rainwater)?
- Have you ever drunk rainwater (what did you think of the taste)?

- | |
|-----------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">• What are barriers to the uptake of this technology/approach in your area? |
|-----------------------------------------------------------------------------------------------------------------------------|

Serving different learning styles

Learning styles are the ways individual learners react to the overall learning environment. Factors that contribute to an individual's learning style can be divided in: cognitive, perceptual, behavioral and affective factors (Burd and Buchanan, 2004). In classroom teaching these factors are served with neither the teacher nor the students being aware of it. The teacher can make use of the physically visible and audible presence of the teacher and the other students in the classroom, the standard presence of a whiteboard and a beamer, etc. In an online setting however we have to be far more pro-active in serving all learning style factors to prevent students from dropping out.

With online learning, participants can feel very detached from the learning process (being in 'Cyberia', like Siberia). This can increase the risk that participants will lose motivation, will fail to follow deadlines, will not exchange experiences with fellow participants and will finally drop out. Preventing student dropout is a key challenge for online teachers (see also Table 5).

When setting up the structure and elements for this ecosan online course, our aim was therefore to deliver a learning experience which would:

- Prevent student dropout (for the case of this ecosan course, not one of the 25 participants dropped out).
- Create a group feeling and encourage participants to learn together (at a similar pace) and from each other's prior experiences.
- Offer the students a variety of learning objects to suit the different learning styles and to meet the students' learning needs.
- Ensure that students receive answers quickly if they have asked a question or experienced a problem.
- Prevent boredom, which may settle in faster when having to sit in front of a computer, rather than being in a classroom.
- Allow student to have debates and to disagree with each other and with the teacher.
- Be fun, personalised and engaging (teacher's enthusiasm should be evident throughout all interactions).

We did not use any synchronous teaching options (e.g. skype or chatting) because these would take up more time of the teacher, the teacher would have to be available at the same time when the student wants to talk, and not all students would be able to benefit from the dialogue. We believe that such synchronous teaching options would have a higher cost-benefit ratio compared to the asynchronous discussions taking place on the discussion forum.

Course structure and elements

The course was split into six sub-courses, each consisting of a number of units which followed a prescribed time schedule, designed to keep the group of students together as much as possible (see Table 3). The total study load of the course was 140 hours or 9 hours per week (equal to 3 weeks full-time study). Learning objectives were defined at unit level (see Box 1). Expected student activities during the course are shown in Table 5 together with the necessary teacher's activities.

The requirements for obtaining a course certificate were: Submitting three assignments of reasonable quality (assignment details explained in Table 4), contributing with their own postings to at least 50% of the Small Tasks on the discussion forum, and making a posting on the discussion forum at least once per week on average (24 out of the 25 participants received a certificate).

Table 3. Detailed schedule of ecosan course, showing all sub-courses and units (students are encouraged to adhere to this schedule but may deviate from it if necessary)

Module week	March					April				May				June			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Course 1 Introduction to ecosan																	
Unit 1: The need for and definition of ecosan and MDGs																	
Unit 2: Characteristics of urine, faeces and greywater																	
Unit 3: Overview of technologies for ecosan (toilets and treatment)																	
Course 2 Transfer and treatment of human excreta and greywater																	
Unit 1: Treatment aspects for urine, faeces and greywater																	
Unit 2: Conventional on-site sanitation																	
Unit 3: Storage and transport logistics																	
Unit 4: Introduction to anaerobic treatment technologies																	
Unit 5: Introduction to constructed wetlands																	
Unit 6: Introduction to composting																	
Unit 7: Faecal sludge management																	
Unit 8: Alternative sewer systems																	
Unit 9: Urban groundwater pollution																	
Course 3 Reuse of ecosan products in agriculture																	
Unit 1: Safe reuse of urine, faeces and greywater in agriculture																	
Course 4 Non-technical aspects of ecosan																	
Unit 1: Financial, social, institutional and policy aspects																	
Course 5&6 Relationship of water supply and ecosan																	
Course 5: Urban water demand management measures																	
Course 6: Rainwater harvesting																	
Assignment topics handed out																	
Assignments due dates																	

Box 1: Example for learning objectives (Course 3 Unit 1 (Safe reuse of urine, faeces and greywater))

- After completing this unit, the student will:
- know basic agronomic principles of soil fertility, fertiliser types and costs, definition of a soil conditioner, concept of limiting factor for plant growth, the meaning of NPK 12:5:10 (abbreviation for nutrient content in fertiliser)
 - be able to estimate the area that can be fertilised with excreta from a given number of people
 - understand benefits (and risks) of applying ecosan products in agriculture
 - understand the importance of the multiple-barrier approach and following the WHO Guidelines for reuse to minimise public health risk
 - appreciate the role of urban agriculture for increased food security in cities of developing countries

The I-Learning Environment

The online courses at UNESCO-IHE are embedded into a platform called the I-Learning Environment (I-LE) which was developed by one of our partners, the Taiwan International Institute for Water Education (TIIWE). The I-Learning Environment offers the elements of a unit (as listed in Table 4) in a structured way. An indication of the layout and menu options of the I-LE is provided in Figure 1. Required activities of the teacher and students before, during and after the course are summarised in Table 5.

Table 4. Elements of online course and their purposes (the large variety of different course elements to cater for the different learning styles of students).

Element	Purposes and comments
Lecture notes in powerpoint format (one lecture per course unit; about 60 slides for units scheduled to take one week)	<ul style="list-style-type: none"> To convey material in succinct form (as it would be used in a face-to-face lecture, but more self-explanatory) Student can use the powerpoint file in his or her own teaching (train the trainer approach)
Voice recordings (mp3 file) to accompany the lecture with the voice of the teacher; typically three 5-minute recordings per lecture were recorded by using free software called MP3MyMP3.	<ul style="list-style-type: none"> To help those students who learn better from listening than from reading To highlight the key slides of the lecture To give additional background information, opinions of teacher or anecdotes
Voice recordings integrated with lecture's powerpoint file (each slide has a voice recording to go with it): For one unit out of the 16 units of the course, we recorded the lecturer's voice together with the powerpoint slides (using 'Microsoft Producer' software).	Same purpose as for the voice recordings in mp3 file format (see row above). Some students found this valuable, whilst others felt it had little additional value because the lecturer just read out the slides and it took longer for the students to get through the presentation. The disadvantage for the lecturer is that this method takes more time during preparation, is less flexible, and that the resulting powerpoint file is much larger.
Video clips of 2 to 10 minutes duration either in wmv format or playing over the internet streaming server (example: mms://mediaserver.ihe.nl/intranet/ecosan_olc_udd_toilet_wme.wmv). The video clips were either recorded purposefully for this online course or taken from other experts or websites, e.g. YouTube.	<ul style="list-style-type: none"> To break up the monotony of just reading and listening To show technologies or applications (like one would do in a field trip) and to clarify concepts To show what the main lecturer looks like when she talks and teaches
Discussion forum with Small Tasks (e-tivities): see earlier section on Pedagogical Background	Note: This was the 'heart and soul' of the course.
Assigned reading: Documents and publications in pdf format as well as powerpoint presentations; around 5 files per unit.	To guide the student to material which compliments the course content, or which looks at the subject from another angle.
Extra materials: Same as assigned reading, but many more items (also includes for example more video clips, links to websites, material submitted by fellow classmates; 10-20 items per unit.	To provide further relevant material for the students on specific aspects of the course unit.
Frequently asked questions: A list of FAQs with short, simple answers for each unit (about 15 questions per unit).	To pre-empt and address questions which the students would normally ask in the classroom.
Glossary of almost 400 terms used in water and sanitation sector (with an emphasis on ecosan) – provided as a help file (.chm format); each word is explained briefly in simple language.	To help those students who have little prior experience in the water and sanitation sector, so that they can quickly look up any words and jargon that may be unfamiliar to them.
Multiple-choice self evaluation questions: about 12	To allow students to check their own understanding of the

questions per unit with 5 possible answers provided per question; once the student has ticked his or her chosen answers, the correct answers are displayed.	material; may also trigger some additional thought processes.
<p>Group assignments: There were 3 assignments during the course, and for each assignment the students had about 5 weeks to complete the task. The students were allowed to choose a topic from a list of six topics (see Box 2). The assignment buddy pairs were assigned via the student topic choices.</p> <p>The assignments could include the task of making a visual 'mindmap' or 'concept map' on a certain topic (by using e.g. the free software MindManager and WinCmap).</p>	<ul style="list-style-type: none"> • To encourage the students to go deeper into a particular topic, which will help to clarify their understanding and concepts. • To provide some peer pressure and peer support by using a buddy pairing system (but in some cases, this did not work out so well, e.g. if one partner had no internet access for a week). • To show students the work of their classmates; friendly and constructive feedback on all assignments was posted afterwards on the discussion forum for all to see. • To reveal to the teacher participants' conceptions and the variations between them.
Ask-Teacher function: students can post a question (visible to all), to which the teacher should reply quickly (say within 24 hours).	To mimic the situation in the classroom where students can ask questions.
Questionnaires: The students evaluated each unit by using an online questionnaire (about 14 questions per unit). Typically, 19 out of the 25 students filled in the questionnaires. The questionnaire was open for about 2 weeks after the unit was completed.	To provide the teacher with detailed feedback about the unit that was just completed (e.g. clarity of powerpoint presentation, quality of voice recordings, etc.) and to be a general 'barometer' of the mood (e.g. asking for reasons why some students had not been posting much on discussion forum)

Box 2 : Example assignment topics (six different topics were offered for each of the three assignments, and the students had to choose one out of the six, which they worked on together with a partner).

<p><i>Assignment 1, Topic Option 1: Water consumption at your work place</i></p> <ul style="list-style-type: none"> • Find out about the water consumption in the building where you work. Then do a small feasibility study about options to reduce this water consumption, with a focus on reducing water consumption from sanitation. Try to estimate how much reduction in water consumption could be achieved (study the powerpoint presentation from Course 1 Unit 3 Part 2). • Do this in parallel for your two work places (in consultation with each other) and then compare and discuss your findings. • Also devise a questionnaire to ask people at your work place about their opinions on your ideas for saving water. Conduct a small survey amongst your colleagues to collect some initial reactions. Compare and analyse results together with your buddy. <p><i>Assignment 2, Topic Option 5: Survey of groundwater quality in your area</i></p> <p>This topic is particularly important if people use groundwater for drinking water in your area. Find out about the quantity and quality of groundwater used in your area or your cities.</p> <ul style="list-style-type: none"> • Try to get data on groundwater quality from the relevant organisations in your country. Compare the groundwater quality for different times of the year (rainy season versus dry season), and any trends over the last years. • What are the main contributors to groundwater pollution in the area, how does it affect people's health and what could be done about it? • Summarise your results in a powerpoint file (20 slides max.).

Course Transfer and treatment of human excreta and greywater 7208

Course Content

- Unit 1 Treatment aspects for urine, faeces and greywater
- Unit 2 Conventional on-site sanitation
- Unit 3 Storage and transport logistics
- Unit 4 Introduction to anaerobic treatment technologies
- Unit 5 Introduction to constructed wetlands
- Unit 6 Introduction to composting
- Unit 7 Faecal sludge management
- Unit 8 Alternative sewer systems
- Unit 9 Urban groundwater pollution
- Unit 10 Course assignments from participants (assignment number 1) and other items from participants
- Unit 11 Video clips (The Human Excreta Index)

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Unit 3 Storage and transport logistics

Course Activities

- Course Content
- Classmates
- Discussion
- Chatroom
- Ask Teacher
- Help
- Close Window

Unit Activities

- Learning Objectives
- Unit Content
- Handouts
 - Notes download
 - Assigned reading
 - Extra materials
- Evaluation
 - Multiple choice
 - Homework
- FAQ

Learning Objectives

After completing this unit, the student will:

- understand the challenges of storing and transporting urine
- be aware of different types of faeces or faeces-water mixtures
- know different safe transport options for different types of excreta (urine, faeces, faecal sludge)
- be able to estimate the minimum number of transport vehicles required to transport excreta from a given number of people
- be able to calculate urine storage tank volumes and know the parameter influencing sizing of urine storage tanks
- know how to design a transport system for urine and faeces, using different types of transport vehicles
- be aware of logistical challenges with respect to transporting urine and faeces

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Unit 3 Storage and transport logistics

Handouts > Extra Materials

File Download

No.	Topic	Size
1	Voice recording for the lecture of Course 2 Unit 3 (about Part A)	1640196 Bytes
2	Voice recording for the lecture of Course 2 Unit 3 (about Part B)	1525932 Bytes
3	Voice recording for the lecture of Course 2 Unit 3 (about Part C)	1993896 Bytes
4	Voice recording for the lecture of Course 2 Unit 3 (about Part D)	2225376 Bytes
5	Kvarnstrom et al. (2006) on urine diversion - this was already provided under Course 1 Unit 3, but it is again very relevant here, especially Appendix 2	2893915 Bytes
6	MSc thesis of Slob (2006) Logistic aspects of ecosan in urban areas, case study in low-income community in Delhi, India - an excellent piece of work	2949268 Bytes
7	A beginning of a spreadsheet which includes the equations from Part D (one assignment topic will be to improve this spreadsheet)	14336 Bytes

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Storage and transport logistics

Discussion

Use your Browser controls to navigate through the discussion. For example when using Microsoft Internet Explorer, use: CTRL-F "Topic" to jump to the next Topic, CTRL-End to jump to the end page, or CTRL-Home to jump to the top of the page.

Post

No. of Topic: 2

Topic	Author	View	Reply	Post Date	Reply Date
This is an example topic: Role of governments in sanitation provision	Module Coordinator : Muench, Elisabeth von	20	1	2007/5/6	2007/5/7
Second example topic: Relationship of soil conditioner and organic fertiliser	Module Coordinator : Muench, Elisabeth von	8	1	2007/5/6	2007/5/7

Figure 1. Four selected screen-dumps of I-Learning Environment using sub-course 2 Unit 3 as an example of some features (see also course demo version on www.lms.ihe.nl with login: ecosandemo and password: 1234).

Table 5. Activities of teacher and students before, during and after the course (teacher's activities aim to ensure quality and prevent student dropout).

Teacher's activities	Student's activities
<i>Activities in months and weeks before the course</i>	
<ul style="list-style-type: none"> • Compile all elements of the course (Table 4), update powerpoint lectures and related files with latest information, obtain permission if using materials from others, and place everything on the I-LE. • Develop a clear structure and learning objectives for each course unit, as well as assignment tasks and assessment criteria. • Advertise the course widely over the internet and by e-mail. • Receive course registrations and select participants. • Analyse scholarship application forms and select scholarship recipients. • Send logins and passwords to students, and ensure technical difficulties are resolved. • Record up to date video message (welcome greeting), which may also show the teacher's workplace. • Send DVD with course material to those students who have a slow internet connection. 	<ul style="list-style-type: none"> • Send registration form. • Make payment of course fee (€ 550) or apply for scholarship (if meeting selection criteria). • Try out login and eliminate any technical problems with internet browser, pop-ups, firewalls etc. • Upload a passport type picture under Personal Profile. • Read list of fellow classmates.
<i>Activities during the course duration of 16 weeks</i>	
<ul style="list-style-type: none"> • Announce and remind students of deadlines. • Read postings on discussion forum, reply and start new topics (but without being overly dominant); set one 'Small Task' per unit on discussion forum. • Answer e-mails and Ask-Teacher questions promptly (tell students if teacher has to be away from internet for a few days). • Upload material provided by students (e.g. documents from their own projects). • Keep track of who is quiet and who is active (send e-mails to very quiet students). • 'Hassle' students who have missed deadlines or who haven't completed the Small Tasks. • Read assignments, post feedback about assignments. • Monitor evaluation results from each unit and make adjustments to material. • Record and send up-to-date audio files on special topics (e.g. about a conference that the teacher attended). • Make weekly course announcements (friendly and encouraging), which are also sent by e-mail. • Contribute to the discussion thread on 'what else is going on in your life?' 	<ul style="list-style-type: none"> • Study main lectures (powerpoint files) and material under Assigned Reading and Extra Materials (listen to audio files and view video clips). • Do three assignments (communicate with assignment buddy by e-mail). • Review the frequently asked questions list for each sub-course. • Check that stated learning objectives for the course units were achieved. • Ask questions on discussion forum or by using Ask-Teacher option. • Frequently read postings on discussion forum, reflect on postings and make own postings regularly (also start new topics). • Make postings to address Small Tasks on discussion forum, and read and reflect about the postings of classmates. • Send own photos or files for the benefit of fellow classmates. • Do multiple choice self-evaluation quizzes after each course unit. • Fill in online questionnaire after each course unit. • Start disseminating knowledge amongst colleagues and friends.
<i>Activities in weeks and months after the course</i>	
<ul style="list-style-type: none"> • Send out course certificates. • Send out updated course DVD with all material and discussions (optional). 	<ul style="list-style-type: none"> • Apply knowledge at work place, raise awareness and teach others about ecosan.

<ul style="list-style-type: none"> • Collect and analyse course evaluation questionnaires, improve and update course material, plan changes for next course. • Stay in touch with ex-students for further collaborations, e.g. via ecosan discussion forum hosted by EcosanRes. 	<ul style="list-style-type: none"> • Take part in global ecosan discussion forum hosted by EcosanRes.
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Student feedback

Most university lecturers in science and engineering conduct no structured research into their own teaching methods. We conducted some research into this ecosan online course, but because only one batch of students (25 students) has completed the course so far, the results presented below are only of indicative nature. We used the online questionnaires mentioned in Table 4 to gather continuous feedback. The main results of the final course questionnaire are summarised in Figure 2 to Figure 5.

From these results, the following conclusions can be drawn:

- It was very challenging for the students to manage their time between their workplace, family and course work (see Figure 3 and Figure 5) – as would be the case for any part-time course;
- The students highly appreciated the exchange of experiences with fellow classmates from all over the world, as well as the discussion forum and the quality of the course material (Figure 4); and
- The internet connection speed remained a challenge for many participants from developing countries and hampered for example their ability to watch video clips over the internet (Figure 5).

When asked about the strengths of the course material, the students mentioned the following aspects: the variety of sources used was good, the material was up to date and relevant, it was good to provide a division of compulsory reading and not compulsory reading, and there was a good mix of material (e.g. many case studies and examples).

The students highlighted the following weaknesses of the material: the course DVD should be provided upfront, some students preferred a voice recording for each powerpoint slide, the teacher should encourage participants to submit own material and then discuss this material, there should be more time dedicated on non-technical issues (sub-course 4) and more information on high-tech options (in sub-course 2).

When asked “what did you like the least?”, the following answers were given (several answers possible):

- Nothing (7)
- Not having enough time or not being able to participate enough in the discussions (6)
- Too much technical details for some of the topics (2)
- Problems with buddy collaboration in assignment (2)
- The following points were each raised only once: Some guest lecturer’s powerpoint presentations were of varying quality, Small Tasks too detailed, self-evaluation questions too difficult, I-LE cumbersome, overwhelmed with materials and discussions, lack of internet access during field trips, Course 2 Unit 9 too academic.

The following answers were given when asked to make “suggestions about didactics / teaching methods”:

- Didactics are good (9)
- Liked the audio recordings and/or would like more audio recordings (4)
- Online chat would be good (3)
- Other points made by one person each: the buddy system for assignments was good; Small Tasks and personal experiences was good; video recordings at certain stages (like the audio recordings) would be helpful; the discussion forum was excellent.

The students also had some suggestions on how to improve the discussion forum: It needs to have a search function, it should have a better structure (tree), the teacher should moderate the discussion more and the I-LE should provide basic information on students when they make a posting (country and photo).

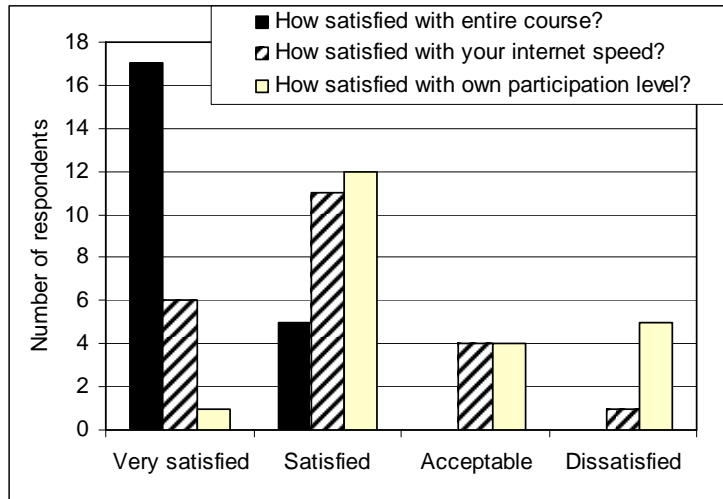


Figure 2. Overall satisfaction level with course, internet speed and own participation level (total number of answers: 22)

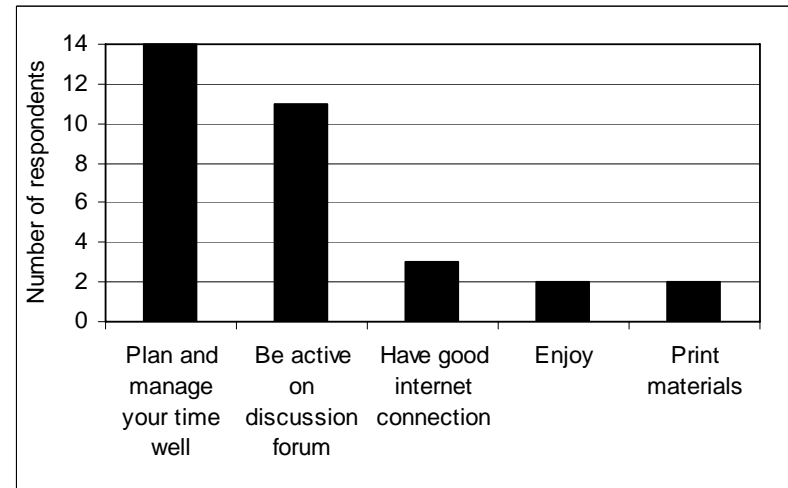


Figure 3. Answers to: "What would you recommend to a new online course student?" (several answers possible; total number of answers: 32)

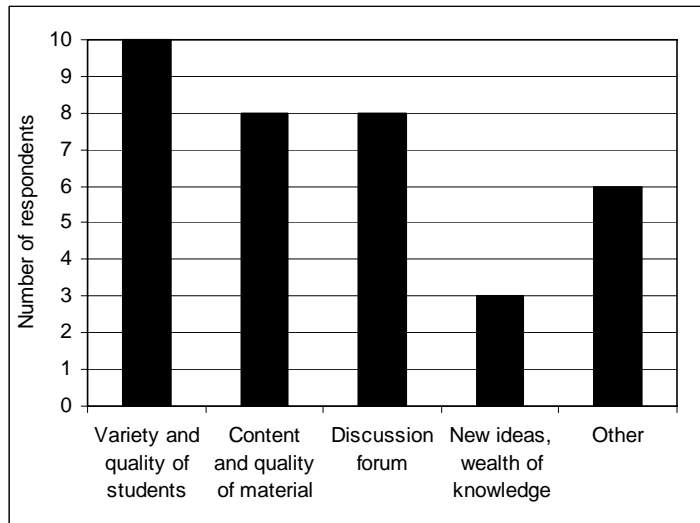


Figure 4. Answers to: "What did you like the most?" (several answers possible; total number of answers: 35; 'others' includes: Assignments (2), teacher's enthusiasm (2), participatory approach to learning (1), visual aids (1))

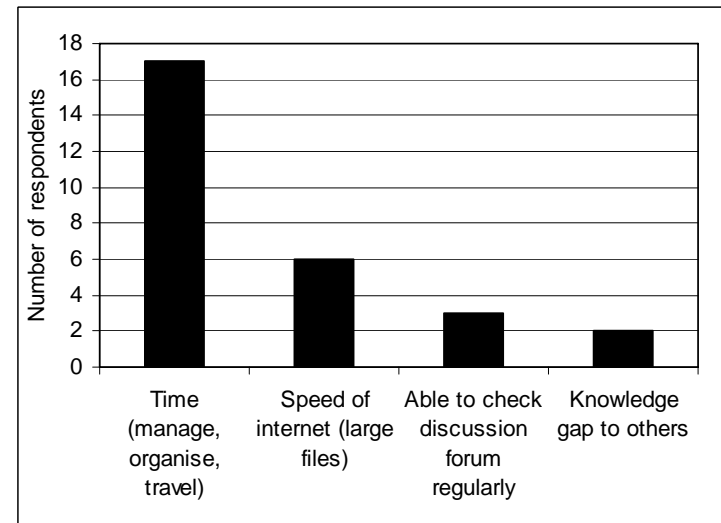


Figure 5. Answers to: "What was the hardest thing for you personally during the course?" (several answers possible; total number of answers: 28)

Conclusions

The ecosan online course for mid-career professionals described in this paper has a number of advantages compared to a 3-week face-to-face course, the main ones being much lower costs for the students (€550 versus €4,100) and no need for long-distance traveling (less CO₂ emissions). The course is set up to cater for different learning styles by using a large variety of course elements. It is based on the principles of a two-way iterative dialogue between the teacher and students, and amongst the students themselves. For this reason, the (asynchronous) discussion forum is an essential part of the course, and it is important that the students follow the 16-week part-time course at more or less the same pace.

In our opinion, the future holds much potential for this and other online courses with content relevant to achieving the MDGs in developing countries. In the future, internet access will continue to spread throughout developing countries; the connection speed and reliability will improve, making it easier to download large files and view video clips over the internet (negating the need to supply off-line course material on DVD); there will also be a continued drive to reduce CO₂ emissions from air travel which will favour online learning where there is no need to travel.

There is an urgent need to build local capacity for sustainable sanitation in developing countries, which means having to train a large number of professionals, worldwide, at low cost. The online ecosan course presented in this paper is one example of how this can be successfully achieved.

Further research questions regarding online courses such as the one described in the paper include:

- What is the optimal group size for such an online course? – We believe that 20-25 may be an optimal size, if at least 80% of the participants are active on the discussion forum.
- How important are the student assignments for the learning process, how long should each assignment run for, and what is the optimal group size for assignments? – We used 5 weeks per assignments and teams of two.
- What is the optimal length of such a part-time online course and what is the optimum weekly workload that students can successfully deal with? – We used 16 weeks and 9 hours per week.
- Can those students who do not participate actively on the discussion forum still learn effectively?
- Is the language barrier for students with poor English language skills higher or lower than in a face-to-face course?
- Are the retention of knowledge and the level of understanding better, worse or no different compared to a face-to-face course?

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