



## Web-based System for Water and Environmental Studies

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**Type of tool:** information technology / education and capacity development for providing the green market with qualified personnel

**Location:** MENA (Middle East and North Africa) with main focus on Egypt



### Introduction

Egyptians have been managing the Nile water for irrigation for more than 5,000 years. However, water scarcity and the dramatic increase in population make the management task more complex because of the conflictive interaction between economical, social, and environmental aspects. Water management has never been only a technical or engineering problem as commonly recognised. Water management must be carried out in an interdisciplinary environment. Water engineers must cooperate with socio-economists and environmentalists to sustainably manage water resources. In Egypt, there is a marked lack of cooperation between farmers and water officials on one hand and even between water officials themselves (irrigation engineers, environmentalists, socio-economists) on the other hand. The exclusive focus on technical aspects in water management is causing many conflicts and problems for the Egyptian water system. Without interdisciplinary and integrated water management procedures, maximising the economical outcomes of agricultural lands leads to minimising the environmental outcomes. Water logging and soil salinity is becoming a serious problem in Egypt. Saline areas in the Nile Valley and Delta were estimated at 1,210,000 ha. Deterioration of water quality is a significant issue caused by the use of chemical fertilisers, which increased fourfold in the last two decades. Many social problems exist. For instance, the involvement of women in irrigation activities does



not exceed 4% of those economically active in agriculture, and this ratio rises only to about 10% when unpaid family labour is included.

There is an urgent need not only in Egypt but also in the MENA countries to improve water resources management and water services, and to accelerate sustainable development in the water sector. Training of different stakeholders, networking of national experts, information exchange and dissemination of proven experiences are essential for the implementation of interdisciplinary water management. Blended learning and exchange of information electronically can contribute to capacity building in water management and sustainable water development. These activities can also provide a framework for North-South and South-South cooperation.

### **TOTWAT**

Think Interdisciplinary: A Training of Trainers Program in Interdisciplinary Water Management (TOTWAT) is an EU funded project under the umbrella of the TEMPUS programme. The consortium of this project is composed of five partners: the Cairo University (Egypt), Alfayounm University (Egypt), the National Water Research Center (Egypt), the RWTH Aachen University (Germany) and the Institute of Advanced Studies (Austria). This project has the development of a Training of Trainers (TOT) programme as a main objective. The training programme should be developed during the project lifetime (3 years) and be made available for the water officials from Egypt and other MENA countries. The specific objectives of the project can be summarised as follows:

- To design the course structures and develop courses' contents.
- To improve the training skills of the trainers of the three Egyptian partners to successfully deliver the training programme.
- To afford the necessary tools and equipments to successfully carry out the courses at both Egyptian universities.
- To develop multimedia, web-based and eLearning tools to support the training programme.
- To improve the skills of the IT administration team of both Egyptian Universities to be able to cope with the new multimedia-based training programme.

The main eLearning platform used in this project was Moodle Learning Management System which supports Arabic language. However, some adaptations were necessary to develop Arabic materials for certain courses. For example, Arabic video integration with PowerPoint was



necessary to develop the online lectures. In addition, Arabic language Quiz for self-assessment was also a challenging issue to have a complete LMS.

### Training Needs Analysis (TNA)

It was necessary to conduct an up-to-date and comprehensive training needs analysis (TNA) prior to the implementation of most of the TOT activities. This activity has been devoted to assessing the qualifications of the ministry staff responsible for the management of the Egyptian water system. The qualifications that have been assessed through questionnaires (first source of information) include the scientific background, IT skills, the knowledge of using computer models and the level of communication between different disciplines (engineers, socio-economists and environmentalists). The second source of information for this activity was direct interviews with the ministry staff. Almost 90 questionnaires were filled by the ministry staff members from all over the country and 20 interviews have been carried out. As an example of the results of the TNA, Figure 1 shows that the majority of the questioned staff members do not use computer models in their daily water management activities.

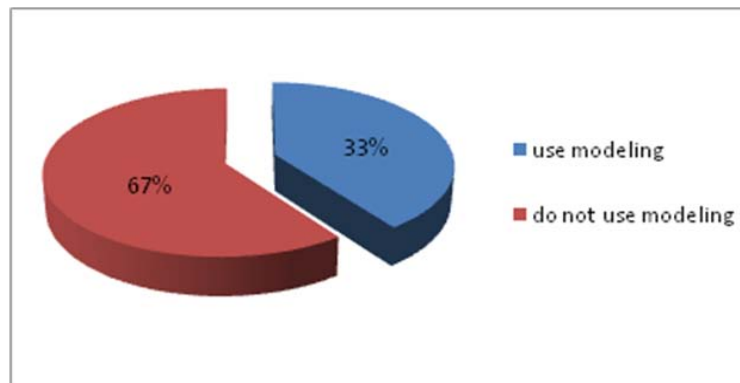


Figure 1. The TNA results (% of using computer modelling)

The TNA showed also that there is a lack of interdisciplinary water management and there is a need to bring engineers together with ecologists and socio-economists in day-to-day water management (Figure 2).

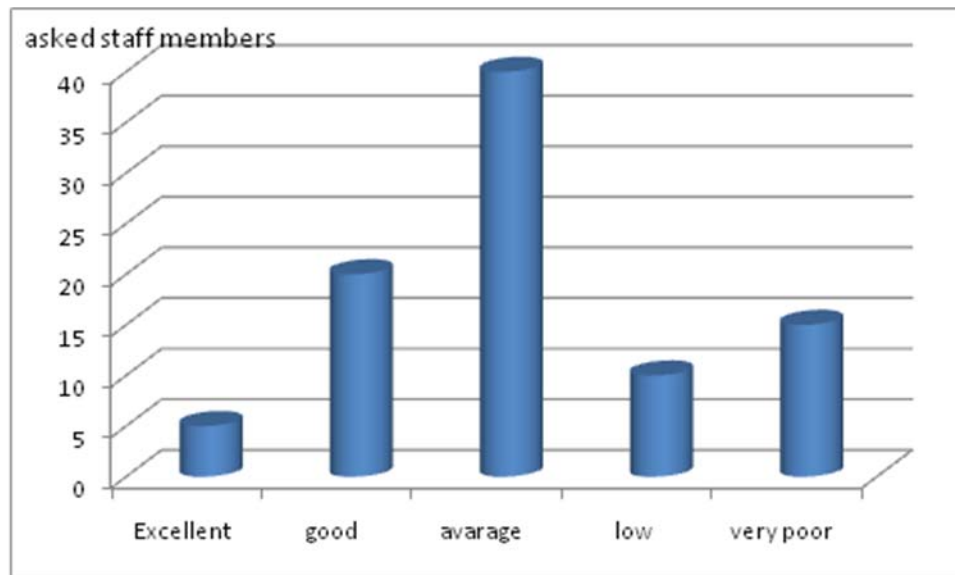


Figure 2. The level of interdisciplinarity in managing water resources

### TOTWAT Training Programme

The TOTWAT Training programme has four targeted groups; water engineers, socio-economists, ecologists and modellers. Therefore, four TOT modules have been designed for the different targeted groups; Water Modeling and eLearning Module, Socio-Economic Module, Water Management Module and Environmental Module. Each target group had to attend two training courses (two weeks each in Egypt and Europe). More than 60 trainees have benefited from TOTWAT so far. All the four groups had to attend the same interdisciplinary training module (Module 5). This training module was composed of practical sessions. The trainees are exposed to a real-world water management problem, and their main task is to solve it in an interdisciplinary environment.

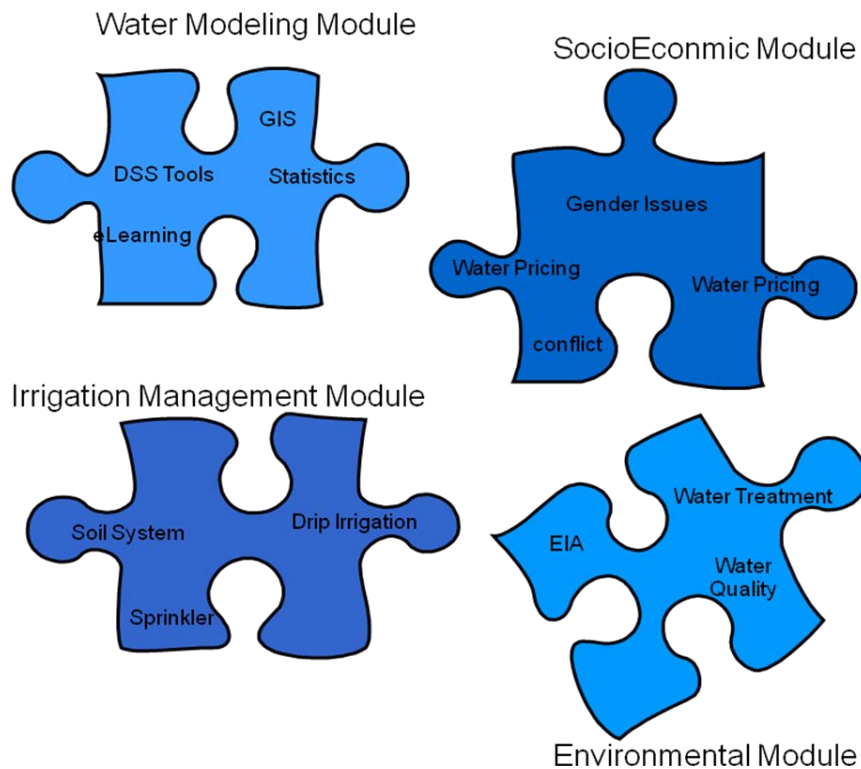


Figure 3. The first four modules of the TOTWAT

### Overcoming barriers to technological development, adaptation and adoption

The main technical challenge in the use of the eLearning technologies of TOTWAT was the unreliability of available home internet connections and their bandwidth.

To offer the users of the system the opportunity to overcome the bandwidth problem, computer labs were established at each of the involved universities with suitable internet connection. In addition, the system was adopted to offer Audio online lectures in addition to the video ones.

The developed LMS enables flexible accessibility for the mentioned target groups from any location and at any time. The system provides online courses to cover topics such as IWRM, EIA, water quality assessment, sustainable resource management, gender issues, socio-economical, desalination, water treatment etc. The courses were designed in a way to ensure understanding the interrelationships between technical, social, economical and environmental aspects related to water management. The LMS includes also a self-assessment tool that enables the learner/trainees to assess their knowledge before and after participating in any online course. The platform (LMS) also offers communication tools that ensure the continuous communication and social learning among the learners from different levels and target groups.



## Lessons learnt: North-South knowledge transfer

This project provides several lessons that can be very important for furthering North-South cooperation in the MENA region. Two main lessons will be highlighted in the next sections.

### *Knowledge transfer through capacity building*

Capacity building and knowledge transfer are critical tools without which developing countries and transitional economies will remain disadvantaged and unable to reap the environmental, social and economic benefits of a green economy. The strategy of TOTWAT aimed to transfer the European knowledge in interdisciplinary water management to enhance the skills of the Egyptian staff members through a capacity building programme. Five training modules have provided a great opportunity for transferring European know-how in interdisciplinary water management to the Egyptian trainees. Lessons learnt from the implementation of these five training modules can be summarised as follows:

- All training modules provided by trainers from European countries should be based on local problems in the south. The main task of the trainers should be trying to introduce European solutions for similar Egyptian situations. The solutions are normally intensively discussed until the trainers and trainees reach an agreement on the adopted knowledge.
- European trainers from different backgrounds had to be involved in the training modules (engineers, ecologists, sociologists, economists, etc.).
- Only trainers who understand and accept other cultures should be involved in such training courses.
- Materials must be as simple as possible because of the various backgrounds of the trainees.
- The training should consider the educational level of the trainees and their English language level.
- Social, religious and cultural habits have to be taken in to consideration while setting the training programme (praying time, feasts, etc.).

### *Knowledge transfer through blended learning*

In TOTWAT, blended learning activities have been implemented very intensively for different reasons:

- To enable knowledge transfer without necessarily being available at the same location (trainers/trainees).





- Digital materials are easily transferred and usable online.
- Dissemination of knowledge to other groups who are not directly involved in the project is quite simple.

The TOTWAT activities are based on the Selection-Organisation-Integration theory (also called SOI theory). The fundamentals of the theoretical SOI model are:

- Human knowledge processing strictly separates aural and visual inputs (two separate channels for information entrance).
- The processing capacity of those two input channels and the short-term memory is limited (the magic seven).
- Learning is always an active process; we have to develop a coherent mental model (or reproduction) of the learning objects.

Based on the assumptions of the SOI theory, Clark & Mayer (2002) developed six principles that should be obeyed during the conception and creation of multimedia contents. The TOTWAT project has made the best out of combining both theories together. The characteristics/principles of the developed eLearning materials for the knowledge transfer can be summarised as follows:

- **Multimedia Principle:** a combination of text and diagrams/illustrations is a more effective method of knowledge transfer than text only.
- **Modality Principle:** explanations and descriptions dedicated to illustrations and diagrams are better grasped in spoken form (aural) than in written presentation.
- **Continuity Principle:** text information and diagrams that refer to each other are presented interrelated.
- **Redundancy Principle:** never present the contents in written and spoken form simultaneously (q.v. Dual Code Theory by Paivio).
- **Coherence Principle:** media elements should be used in a targeted and economical (thrifty) way; an overkill will have negative consequences for the learning process.
- **Personalisation principle:** expert sociolects should be avoided; in general, comprehensible explanations enhance and enrich the learning effect.





Based on the SOI theory and these principles of multimedia-based learning, in TOTWAT the materials have been designed in such a manner that more or less 80% of the information to transform into knowledge is presented in an aural way (independent of setting up a classical face-to-face or a pure eLearning module). Animated graphs, flash files or video sequences will fill the residual part.

### *Blended Learning Modules for the MENA Region*

Two years of the project lifetime have been spent developing the blended learning materials. The final product is a blend of training technologies that answer the needs of many water institutions in the MENA region. The most important characteristics of the developed web-based systems are:

- Materials are available online and in Arabic language
- The training covers water related issues that fit the MENA region problems
- Moodle system (Learning Management System) also supports the Arabic language
- Simplicity of “learning how to learn online” – 10-15 minutes are required to learn navigation basics and some more time is needed to master learning in this type of environment

The eLectures are an essential tool for learning online. For each of the five modules, a series of eLectures have been developed. The lectures include a video of the lecturer synchronised with the PowerPoint presentations. This makes learning online very easy for the trainees. The techniques adopted allow any user to access the LMS and simply watch the lecture without any additional installations. Figure 4 shows an example for one of the lectures under the socioeconomic module that covers gender issues.



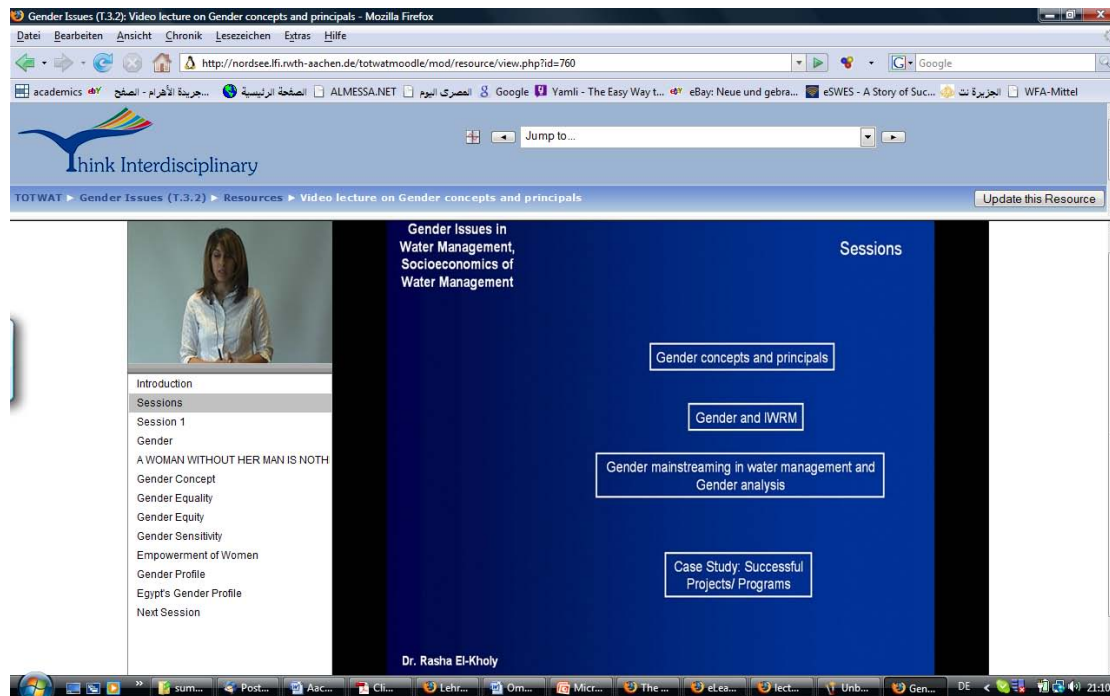


Figure 4. An example of the gender issues lecture of Module 4 (socio-economic in water resources)

In addition to the eLecture, the Learning Management System includes for each lecture a handout in the form of a pdf file. The handout describes the details of the lecture and provides references and case studies for the investigated subject. To assess the gained knowledge of the trainees, the LMS also offers a self-assessment system. This self-assessment system allows each trainee to go through an assessment process composed of ten different types of quiz (multiple choice, matching, short answer, essays, etc.). Each trainee can try the assessment and get the final grade of his/her answer. The trainees can also view the correct answer to enhance their knowledge.

### Scaling up and relevance for developing and transition countries

The developed LMS and training materials of this project were used by other Egyptian universities. At a later stage the Ministry of Higher Education realised the acceptance of such technologies for education and capacity development. The government started to promote using such technologies for undergraduate students by motivating the professors to develop their undergraduate courses using web-based techniques.





## **Evaluation: economic, environmental and social benefits**

### *Economic*

The developed LMS is officially used by Zagazig University for civil engineering undergraduate students. More than 1,200 students have used this system for their courses. The impact assessment of the project on this group has shown enormous enhancement of the quality of graduates, especially in their knowledge of sustainable water management. In some cases, students started up their own business mainly in areas related to decentralised small water treatment unities for rural areas.

Two universities in Egypt (Helwan and Ain Shams Universities) are now using this system to enroll and teach a postgraduate diploma on “water and environmental management”. The universities have already signed different agreements with the local water and environment companies/consultancies to supply them with engineers with specific qualifications.

The LMS now enables Cairo University together with the National Water Research Center to offer training services for the professionals of the Ministry of Water Resources. According to the assessment of the impact of such training activities, the training has enhanced the skills of a large number of the water professionals responsible for managing water resources as well as researchers from the NWRC.

### *Environmental*

The online modules developed included many environment related courses which helped thousands of people enhance their environmental capacities and knowledge.

### *Social*

Although eLearning is often seen as a tool that has negative impacts on social communicating, such systems include social networking tools that bring not only people from the same country to communicate and work together but also people from all over the world who have common interests.

## **Conclusion**

Knowledge transfer is one of the key tools to help the MENA Region to cope water scarcity and the serious impacts of climate change. One of the main mechanisms for knowledge transfer is capacity building. North-South cooperation to develop and organise training programmes is a key approach. Using blended learning techniques facilitates knowledge transfer and allows more countries and stakeholders to benefit from such programmes.



TOTWAT is an example of such north-south cooperation, serving to transfer European knowledge in the field of interdisciplinary water management to Egypt. More than 10 training courses have been organised in the fields of modelling, water management, socioeconomics, environmental engineering and interdisciplinary water management. The project also produced blended learning contents for dissemination and use by other water institutions in the MENA region. Through a network of national institutions and on-going projects of technical cooperation in the water sector, RWTH Aachen, along with other international partners, can organise and facilitate the exchange of capacities, experiences and relevant information with potential multiplier effects.

### References

<http://blip.tv/eswes>

<http://blip.tv/totwat>

<http://blip.tv/waten>