COMMUNITY BUILDING AND CROSS-BORDER COLLABORATION THROUGH ONLINE COURSES IN WIND ENERGY

M. Badger¹, A. Monty², J. Badger¹, J. Berg¹, F. Bingöl¹, T. Cronin¹, S.E. Gryning¹, B.O. Hansen¹, H.E. Jørgensen¹, I. Karagali¹, M.C. Kelly¹, S.E. Larsen¹, N.G. Mortensen¹, R.A. Nielsen¹, A. Peña¹, O. Rathmann¹, L. Stenbæk¹

¹Technical University of Denmark (DENMARK)
²Expect Learning (DENMARK)

E-mails: mebc@dtu.dk, anita@expectlearning.com, jaba@dtu.dk, jbej@dtu.dk, febi@dtu.dk, tocr@dtu.dk, sveg@dtu.dk, bohh@dtu.dk, haej@dtu.dk, ioka@dtu.dk, mkel@dtu.dk, sola@dtu.dk, nimo@dtu.dk, rini@dtu.dk, aldi@dtu.dk, olra@dtu.dk, liste@llab.dtu.dk

Abstract

A new online course in wind energy has been developed by the Technical University of Denmark (DTU) as part of the EU-funded project Virtual Campus Hub (FP7 RI-283746, www.virtualcampushub.eu). The course builds upon a successful physical course, which has been offered to the wind energy industry for more than 20 years. The course objectives are:

1) To teach participants to use the Wind Atlas Analysis and Application Program (WAsP) – the wind power industry-standard PC-software for wind resource assessment and siting of wind turbines and wind farms, with more than 4,000 licenses sold in more than 100 countries.

2) To provide participants with enough theory about wind power meteorology to avoid the major pitfalls in wind resource assessment.

This paper describes the design and implementation of the online course in WAsP and the most important learning points gained from two test runs of the course. The course is then placed in the larger context of project Virtual Campus Hub where participants from four technical universities in Europe collaborate in a virtual framework utilizing state-of-the-art European E-infrastructure.

Keywords: E-learning Projects and Experiences, E-moderating, Community Building, E-learning for environmental sustainability, Mobile Learning, Learning Management Systems.

1 INTRODUCTION

1.1 Motivation

The demand for knowledge about wind resource assessment has increased dramatically with the global expansion of wind energy over the last decades. The demand originates from the wind energy industry itself but also from universities. Renewable energy courses are becoming more widespread and are often offered as part of joint educational programs with several international partner universities. For example, the Department of Wind Energy at the Technical University of Denmark (DTU Wind Energy) participates in a European Wind Energy Master program and also in the Nordic Master of Innovative and Sustainable Energy Engineering. The team of researchers behind the WAsP software and training courses is facing an increase in teaching and traveling activities. This is an important motivation for developing an online version of the existing WAsP course.

The WAsP course in its physical form is held over three days. Due to the very high intensity of the course, the time for reflection and discussion of the different course topics is limited and some participants report that they feel overwhelmed by the large amount of new knowledge they must digest over the three course days. It can also be difficult to complete the hands-on exercises in WAsP within the short time that is given. A second motivation for developing an online WAsP course is to allow course participants more time to work with the course material and to discuss and reflect over their findings.
Course participants normally travel to DTU or, if a larger group can be gathered from a given company or institution, DTU staff will travel out to teach the course. The traveling is costly and time consuming for both teachers and course participants. Some WAsP users, who are located far from Denmark and DTU, cannot participate in a course because the traveling as well as visa application procedures are costly and time consuming. A third motivation for developing an online WAsP course is that more WAsP users, both from the wind energy industry and from universities, can be reached.

1.2 Course development

The online version of the WAsP course has been developed by a team of scientists at DTU Wind Energy who have many years of experience with teaching of WAsP courses. An external E-learning consultant has helped the scientists decide on the pedagogical concept and technical solutions for the online course. A series of workshops have been held to define the course structure and review the status of the course development. Between workshops, the scientists have worked on the course content. The course development has taken approximately 750 hours of effective working time spread over one year. Additional time has been spent on two test runs of the course and on documentation and promotion activities. It has taken 1.5 years in total from the course development has been initiated until the course was ready to be offered to commercial clients from the wind energy industry.

2 COURSE DESIGN

2.1 Course duration and structure

The online WAsP course is designed to run over 10 weeks with a total estimated workload of 40 hours for the participants. Each week, participants must complete one course module with an estimated workload of four to five hours on average. The participants have the flexibility to work any time they want as long as the modules are completed by the weekly deadlines.

Each of the course modules contains three to four E-lessons with a fixed structure. The E-lessons always contain an introduction, a set of learning objectives, and a list of tasks, which the participants must complete. Fig. 1 shows an E-lesson example. Examples of tasks could be:

- View a Power Point presentation with recorded narration
- Perform an exercise in WAsP
- Reflect over a question related to the E-lesson topic
- Share knowledge with fellow course participants in a discussion forum
- Perform a quick multiple-choice self-test

Group discussions are very central in the course. In order to create a safe learning environment where participants are not afraid to share information openly, the participants are divided into groups of 10-12 persons. The course can be run with multiple groups of participants simultaneously and the course design is therefore very scalable.

2.2 Learning Management System

The cloud service ‘itslearning’ (www.itslearning.com) is used as a learning platform for the WAsP course. The course modules and E-lessons are organized in a hierarchy of folders and files under the main course folder in the Learning Management System (LMS). This makes the course structure very clear and easy to navigate. In addition to hosting the course material itself, ‘itslearning’ supports messaging and online discussions in forums. The platform also comes with functionalities, which the teachers can use to support participants and give them feedback in their progress of learning. The LMS and the course components can be accessed from any web browser and from mobile devices with an internet connection.
2.3 E-moderating

Teachers of the course act as E-moderators whose main function is to moderate discussions amongst participants and to respond to any questions about the course content. This type of teaching facilitates a high degree of interaction between the teachers and the course participants. The WASP course is run by a number of scientific E-moderators, who may change from module to module and from one course run to the next.

In addition to the scientific E-moderators, each course run requires an administrative E-moderator who ensures that the course is running smoothly altogether. The WASP course is run with the same administrator for the 10-week duration of the course to give the participants a sense of continuity and an anchor person to contact about technical problems, delays, and other inquiries.

The administrative E-moderator has two main functions. The first is to write bulletins frequently on the course ‘dashboard’, which is the gateway to the course environment in ‘itslearning’. The messages can contain any kind of announcement e.g. reminders of important deadlines, updates of the course content, tips about the LMS, or simply some background information about the course topics or the course provider. Photos and ‘emoticons’ are used frequently in these announcements to achieve an informal and interesting style of communication. An example is shown in Fig. 2.
The second function of the administrative E-moderator is to follow-up on the participant's progress. 'itslearning' can be used to get an overview of the status for all participants (percentage of tasks completed) and it is also possible to generate a detailed report of the progress for specific participants (Fig. 3). Whenever a participant gets delayed, the administrative E-moderator takes direct contact and tries to motivate the participant in a friendly way to continue with the course work.

2.4 Pedagogical model

The learning design of the online WAsP course is based on a research based scaffolding model for building up communication and participation for learners online [1]. The theory of the model is a social constructivism and constructionism approach to learning, which means that learners will benefit from interaction with others in their learning process. Fellow participants and the teachers support the learner's cognition and their critical reflection as they go through structured online activities called ‘E-tivities’ together. As the course progresses, participants climb up the learning scaffold and become more independent and responsible for their own learning. The five-stage model has been implemented successfully at universities [2] but here we use it in connection with continuing education courses for wind energy professionals.

In the context of the WAsP course, the five-stage model has been implemented as follows:

2.4.1 Stage 1 – Access and motivation

The first course module called ‘0. Welcome to the WAsP course’ is designed to cover the first stage of the scaffolding model. Here we focus on access and motivation. Participants first see a welcome screen with photos of the E-moderators and links to their personal profile pages. The E-lessons of this module are used to distribute some practical information and useful tips about the course and the learning environment to the participants. Participants have to install the WAsP software and any problems with access to the learning environment and WAsP are solved.

The first course module also contains some very simple socialising activities. For example, the E-moderator has written a welcome message in a discussion forum (Fig. 4). The participants are asked to post a response to the welcome message to show they have accessed the course environment and are ready to begin the course. The participants are also encouraged to upload a photo and a brief description of themselves.
2.4.2 Stage 2 - Online socialisation

The next course module called ‘1. Introduction to WAsP’ addresses online socialisation – or the second stage of the scaffolding model. Participants go through a series of E-lessons which contain introductory presentations about WAsP. The E-lessons also contain a number of socialising activities where participants are asked to share a little more information about their background and interests (Fig. 5). The participants are encouraged to return to the discussion fora later to see and respond to posts by others. The E-moderator will respond with comments to individual posts or summarize a group of posts in a positive and encouraging manner, which serves to establish a safe and motivating learning environment. The online socialization is essential for achieving a high level of interactivity in the later course modules.

2.4.3 Stage 3 – Information exchange

The scientific content of the course increases significantly in the modules two to five, which cover the third stage of the scaffolding model. In these modules, participants go through a series of E-lessons where they learn to use specific WAsP functionalities for working with maps and wind observations. The socialising aspects are still kept in mind but the participants should now be used to sharing information openly with each other such that exercise results and reflections over the course topics are posted frequently in the discussion fora. The role of the E-moderator is to facilitate the group discussions and support the participants as they work through the E-lessons and tasks (Fig. 6). The E-moderator continues to be friendly and encouraging.
2.4.4 Stage 4 – Knowledge construction

In course module six and seven, participants work with the outputs of WAsP. The interpretation of WAsP results requires more reflection and critical thinking than the exercises in previous modules and the participants are meant to use each other to discuss the outputs. They should now have reached the fourth stage of the learning scaffold and the group discussions are less dependent on the E-moderator. The role of the E-moderator is to make sure discussions remain on the right track according to the learning objectives. This can be ensured through posting of new questions or comments whenever a discussion gets side-tracked.

2.4.5 Stage 5 - Development

Participants are expected to reach the fifth stage of the learning scaffold just before module eight in the WAsP course where the format is changed to a case study. This represents a much more independent working style. Once the participants have worked through the case study, they will gather in four-person groups for peer-to-peer assessment of each other’s results. The participants can use each other to catch any major mistakes such that everybody gets a final result which is realistic. All of the final results are uploaded to a table. For the case study, it is very important that the participants feel comfortable about asking their fellow course participants for help, if needed. The E-moderator can focus on summarizing the different results and the pitfalls of the case study (Fig. 7).

2.5 Criteria for passing the course

In order to pass the WAsP course and receive a course diploma, participants must complete at least 8 of the 10 course modules by their end time. A module is considered complete when the following is fulfilled:

- The participant has followed all E-lessons and performed the associated tasks for the module
- The participant has posted a minimum of one comment per module in the fora for group discussions
- The participant has filled out the module evaluation form by the end of the module
3 TESTING THE COURSE

Two test runs of the WAsP course have been performed. In the fall of 2012 the course was run internally with 12 participants from DTU Wind Energy. All of these participants completed the course and received a course diploma (completion rate: 100%). The test and the participant's feedback are described in detail in [3].

The course has been improved according to the participant's feedback and run again in the spring of 2013. This time, participants were recruited from the wind energy industry and from the four partner universities of the Virtual Campus Hub project. The participants were located in many different countries (Fig. 8) and had very diverse scientific and cultural backgrounds. A total of 20 participants completed the course and received a diploma (completion rate: 83%).

![Fig. 8. Map showing the location of participants in the WAsP course. Image courtesy Google Maps.](image)

The overall feedback from the course participants was very positive (Fig. 9). All participants agreed that the online learning process was fruitful and that they would recommend the online WAsP course to others. Further, the majority of the course participants rated the level of the course and the 10-week duration 'just right'.

Based on the participant's and E-moderator's feedback, the following learning points can be listed:

- The 5-stage pedagogical model has worked – course participants were not afraid to share information and communicate online.

- Interactivity (group discussions, group work) kept participants motivated – small groups of four worked particularly well because nobody could 'hide'.

- Follow-up on participant's progress was the key to achieving a high completion rate of the course.

- Most participants and teachers enjoyed the flexible working style and the opportunity to spend as much time as they needed – it gave more time to reflect and participant questions were more 'thought through' compared to questions that are typically raised during a physical WAsP course.
Feedback from the test course also revealed some challenges in relation to the online learning process. These challenges are listed below together with possible solutions, which have been discussed by the team behind the online WAsP course:

- **The time spent on teaching the online WAsP course is comparable to the time it takes to teach a physical WAsP course – E-moderating and follow-up on student progress takes time.**
  
  **Solution:** Automate administrative tasks and make a database of questions and answers for E-moderators. Improve socialising activities at stage 2 in order to get an even better online environment, which will facilitate that participants respond to each other and remove parts of the workload from the teacher.

- **Criteria for passing the course must be very clear and easy to manage.**
  
  **Solution:** Define criteria which can be measured by the learning platform.

- **Both of the test runs showed a division of participants – some were fast and very motivated; others were delayed and less motivated.**
  
  **Solution:** Add mid-week deadlines to motivate participants to start earlier on the week’s course work. Try to make the participants more enthusiastic through inspiring E-moderator contributions. Challenge some of the fast learners a little bit more and make them contribute with their huge knowledge and experience.

- **The learning material must be very precise for recorded presentations.**
  
  **Solution:** Be consistent with terms and minimize overlaps in the content from module to module.

- **The quality of audio and video must be very high.**
  
  **Solution:** Purchase semi-professional sound equipment so it is easy to update the course material and record presentations for future online courses in-house.
The online WAsP course is now ready to be offered as a commercial course for wind energy professionals. The first commercial course run will be launched in early September, 2013. See www.wasp.dk for advertisement regarding this course. The integration of the course with university programs and courses is in progress at DTU and also as part of joint educational programs.

4 CONNECTING TO THE VIRTUAL CAMPUS HUB

The WAsP online course is one of several e-learning applications which are currently being linked together in the Virtual Campus Hub project. The project represents a pioneering effort in using high-speed European E-infrastructures (Géant) and single sign-on for cross-border collaboration. This is advantageous in connection with joint educational programs and any other kind of international collaboration between universities and the industry.

Another contribution to EDULEARN13 will focus on the Virtual Campus Hub environment. See abstract id 815: VIRTUAL CAMPUS HUB: A SINGLE SIGN-ON SYSTEM FOR CROSS-BORDER COLLABORATION.

Further information about the Virtual Campus Hub project can be found at www.virtualcampushub.eu.

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