SvalSim—field work simulation system for problem-oriented learning in petroleum geology

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Abstract

The Educational Technology Unit at Karolinska Institutet (KI) in Sweden has developed an on-screen simulation software, *SvalSim*, that simulates field work for problem-oriented learning in petroleum geology. The system is using numerous authentic geological data, takes the time aspect into account and lets users control almost all events resulting in a very realistic simulation.

The educational setting for use of the simulation software is general training in geosciences and field courses in Norway e.g., at Svalbard. This article describes the system and the pedagogical objectives.

Background

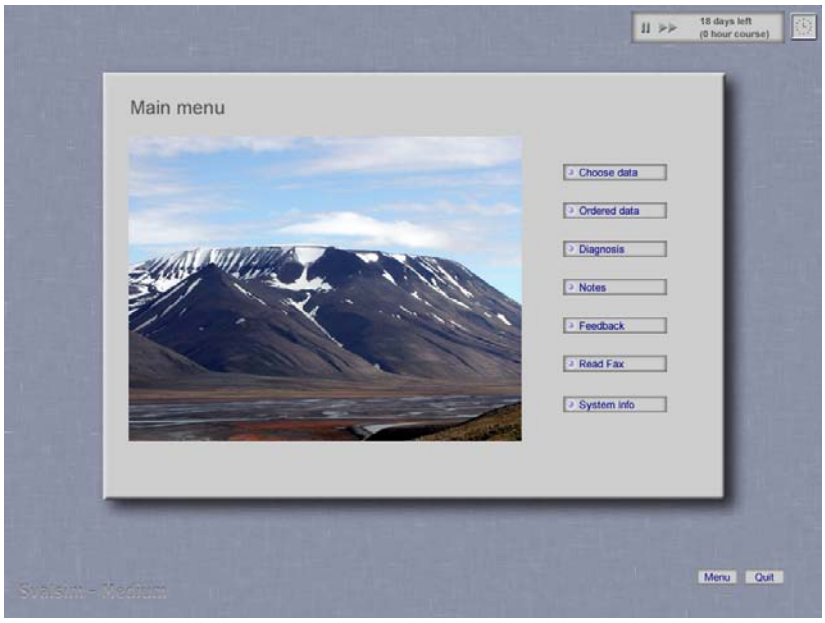

Figure 1. Main menu of *SvalSim*

Training of geologists or geophysicists in exploring the subsurface is generally performed by on-the-job training during busy commercial projects. There are not many opportunities for students to try out different approaches themselves. This project is designed to meet these challenges by involving students in training real-life problems with the help of a virtual simulation.

Software

One of the conditions for developing the software was that students should be able to use it on an ordinary PC laptop at location on actual field work sites with no or very limited Internet access. As a result, the software was designed to be used on any standard PC running *MS-Windows*. This adds to the flexibility of use in a number of different course settings.

Authentic data

Within the simulation scenario, students are asked to perform an exploration task in a realistic virtual environment. The location chosen is the Medium mountain at Svalbard. Huge amounts of data from the surroundings are available to students to order. The data is authentic and originate from the real location. Among them are magnetic measurements, well data, seismic and geological measurements and photographs from the area.

Figure 2. Data selection menu

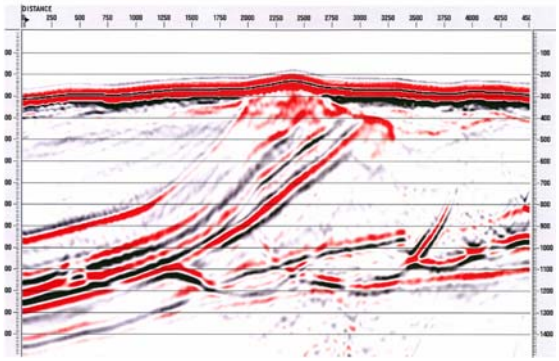

Figure 3. Data – depth section

Simulated time and budget

Students, preferably working in small groups, start the program and get introduced to the landscape. They receive an introduction and their assignment by a video call from the Director of an oil company. He needs to know if it is worth drilling for oil in the area. The team is given a certain amount of days to produce the result: a prospect evaluation, together with a geological model and history of the area.

As soon as they accept the assignment, project time starts running. They also have a specific budget at their disposal, which is valuable, because not much information about the area is free. The user has full control over the selection of data and all analysing steps. However, every piece of data has to be ordered, at a cost, and comes with a delivery time! This puts focus on **what** to order and raises demands of analysis of the data that they already have ordered. When half of the project-time has passed, the director unexpectedly demands a preliminary report. When all of the time is out, no further order of data can be made; a final report has to be submitted to the director.

Figure 4. Some data are ready to analyse, some are pending and not available yet

Adaptability

Svalsim is highly adaptive to the skill level of the learners since it contains enough data for a detailed study as well as a basic case to the exploration challenges. The available (virtual) project-time and budget are parameters that affect the level of difficulty in the simulation. These initial values are set by teachers according to competences and background of student groups, as well as to the actual course curriculum.

Figure 5. Order form for Satellite Data

Pedagogical objectives

The primary pedagogical objective is to present a problem for the student group, the exploration task. In order to solve the problem, they primarily make use of resources within the computer program, but also resources outside the immediate environment. The software is a vehicle for activating students' own thinking of ways to solve problems in field work. The setting incorporates problem-based learning to create a robust, valid knowledge in the domain. Embedding education in a narrative structure like this simulation also contributes to highly motivated users.

Figure 6. Assignment details sent by fax after a meeting with the Director

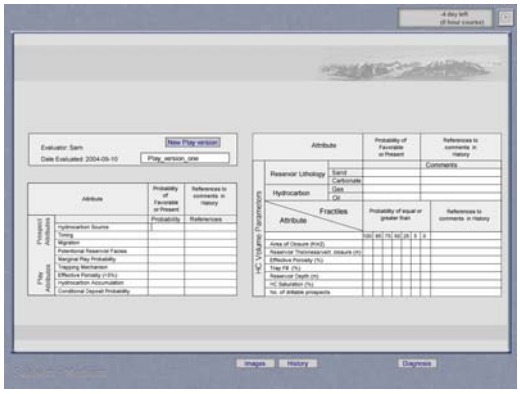

Figure 7. Part of final report, 'play probability'

Furthermore, since petroleum geology and prospecting is a complex process, there is no gold standard for solving a 'case'. Using the log files of the system, teachers and experts might collect data and discuss different ways of approaching the project with the students in a following seminar.

System development of *SvalSim*

The technical development has been performed at Karolinska Institutet (KI) by the Educational Technology Unit (ETU) at the department of Learning, Informatics, Management and Ethics (LIME). ETU has been developing, and performing research on, advanced software based simulated environments for learning since the 1970s. Due to the fact that KI is a medical university, most systems have been devoted to the medical area, but our interest for simulations have also led to projects in archaeology and geology. Currently more than ten different projects are being carried out at ETU. Please see http://lime.ki.se/cul_cd_et_projects.htm for more information.

The development team at KI was approached by the members of the Geo2000 project of Statoil A/S, inviting us to develop the simulation at hand. The development was made as a collaborative project between KI, Statoil A/S and GeoFrontier A/S in Norway. Statoil and GeoFrontier provided most of the data and geological know-how. KI developed the system, performed all image processing and also provided most of the educational know-how.

SvalSim was selected as winner of The European Academic Software Award 2002.
http://lime.ki.se/cul_cd_et_projects_svalsim.htm