Avalanche education with mLearning

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1. Introduction and motivation

In Switzerland an average of 22 people per year die in avalanches whilst taking part in recreational activities outside of ski pistes. Many of these accidents could probably be prevented if skiers did not travel on slopes where obvious warning factors were present (McCammon and Hägeli, 2004). In estimating the risk involved in skiing a particular slope a range of factors must be considered including terrain, snowpack and weather factors – the so-called avalanche triangle. To ease the decision making process for recreationalists a number of simple decision making tools have been developed for use both in planning trips and while in the terrain (e.g. Munter, 2003). In conjunction with such tools, avalanche education is delivered through a wide variety of medium (for example books, classroom courses, lectures and courses in the field). Recently, increasing interest in new media has led to the development of new strategies for delivering avalanche education. For example, in 2006 the Swiss Federal Institute for Snow Avalanches published an interactive eLearning CD for those wishing to learn more about how to identify and avoid avalanche slopes (Harvey, 2006).

However, a significant difficulty in learning about avalanches remains in the translation of theoretical knowledge to its useful practical application. So-called “mobile Learning” (mLearning) is suggested by Okamoto et al. (2001) as being a possible means of bridging this gap between theory and practice, through the delivery of learning materials to a user who is in a realistic learning environment on a Personal Digital Assistant (PDA). Sharp et al. (2003) argue that mLearning offers the possibility to support informal, situated, context dependent and cooperative learning. In turn, a key element of context is location, and through the use of GPS materials specific to a learner’s location can be delivered (Kondratova, 2004).

Here we describe the development of a location-based system for avalanche education, mAvalanche, whose aim is to teach methods relevant to the estimation of avalanche risk in avalanche terrain.

2. mAvalanche

In order that learners can carry out the exercises in mAvalanche in a safe but realistic environment, the materials have been implemented for a variety of routes within a ski area. A number of “learning routes” have been developed, each containing “learning posts”. Learners travel to the learning posts, where factors relevant to avalanches are introduced and illustrated through text, pictures and film and a series of exercises to reinforce and test learning are delivered. The exercises use the learner’s actual position to retrieve values from spatial datasets, so that for example, an estimation of slope can be compared with that stored on the PDA for a location. In principle, such exercises where the learner has an opportunity to self-test, should lead to a significantly improved understanding of the underlying concepts (Pavard and Dugdale, 2002). Since a key aim of mLearning is to further both self and collaborative learning, the materials are designed to be used either in small groups or alone without the need for an accompanying instructor.

3. Design requirements

In order to develop mLearning materials in general, and mAvalanche in particular a number of design requirements must be considered. These include the following:

- An application framework allowing the development of interactive content is required
- The application framework should be capable of loading learning content stored in a given (and standard) format
- The format used for storing learning content should embrace current didactic best practice in e-learning
- It should be possible to include multiple types of content: e.g. text, images, film and interactive animations
- Interactive elements should be developed to allow access to relevant location-based information (e.g. coordinates, context-specific mapping, current position)

4. Implementation

A prototype version of mAvalanche has been implemented in the Windows Mobile Operating System. The application itself is programmed using the Compact .Net Framework in C#. Through the use of OpenNetCF and ActiveX components multimedia components can be easily embedded.

Learning content was developed within the open source XML framework eLML, which is already used in a variety of eLearning products (Fisler and Bleisch, 2006). eLML is based on the didactic concepts encapsulated in E-CLASS (Gerson, 2000):

- Entry: The introduction to a lesson or unit (where a lesson may contain one or more units)
- Clarify, Look, Act: The content of a unit must contain one or more of the three elements of theory, examples and activities.
- Self-assessment: Exercises and group work should allow the learner to measure their progress at the end of a unit or lesson

- Summary: Every lesson should end with a short summary.

By using the E-CLASS schema two separate and important aims are achieved. Firstly, the developer of content is directed towards a didactically proven (and relatively standard) structure for the provision of learning materials. Secondly, by using eLML, the representation of the learning materials is cleanly separated from the content. Currently, mAvalanche supports all of the main tags in eLML.

The development of mAvalanche is an interactive process where both the usability of the application and the quality of the content must be constantly reevaluated. For example, one early result from testing suggested that users wanted to quickly undertake exercises relevant to their environment and had little patience to read large amounts of text. This resulted in a significant redevelopment of the content to place exercises at the centre of the learning materials.

5. Case Study

During the winter of 2006/7 mAvalanche will be tested in the Parsenn ski area with a variety of users for a specific learning route (slope) which is illustrated here.

Figure 1: The lesson begins by illustrating basic concepts related to slope in words and pictures. To ease understanding of concepts, films and interactive animations are used wherever possible. Figure 1 shows an example learning object, where a short film illustrates how ski tourers can estimate slope angle using ski poles. Such material is much more easily understood through such an animation than a diagram, with the added advantage that the user can immediately practice the method in the field.

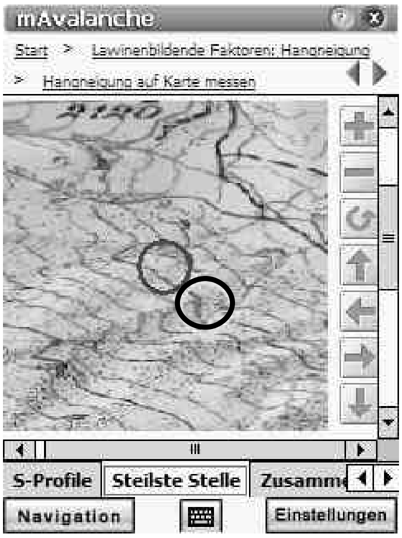

Figure 2: The main interactive learning objects in this lesson allow the user to estimate or measure slope at any point in their route and compare their values with those derived from a DEM for their actual position. At any time, the user can view their current position on a map and thus navigate to the next learning post. In the learning object on shown, the user is asked to estimate the steepest point on a route, before their answer is compared with that calculated on the basis of their actual route through the terrain.

5.1. Evaluation

An important, and oft-neglected, element of the development of new modalities in learning concerns evaluation. In the case of mLearning, we have hypothesised that the use of context-dependent materials in a realistic environment should improve learning success. However, without significant resources and a well-designed evaluation such hypothesises are in practice very difficult to evaluate. In a first stage of testing in the winter of 2006/7 we will evaluate a simpler question – “Is mLearning a practical means to deliver materials related to avalanche education?” Users will test the system in the field, and afterwards be asked to complete a questionnaire covering a number of aspects including their previous experience, the quality of the learning content and the usability of the mAvalanche system. At the time of writing we are carrying out beta testing of the system in the field, prior to user tests. We expect to report on our experiences of these user tests at GISRUK.

6. Summary

We have reported on a system in which context-specific avalanche education materials are delivered through an LBS. A key aim of this work is to deliver avalanche education in a realistic environment, in order that the learner can practice the skills they are developing in a realistic but safe environment. A further, and important aim in mLearning is to link the activity which learners find fun directly with learning in the hope that this will lead to greater success in achieving learning objectives.

By integrating eLML in the application, the diadactic concepts encapsulated in E-CLASS, which are designed with distance and independent learning in mind, have been included in mAvalanche. The use of this schema means that authors can quickly and easily develop further lessons for delivery as mLearning applications.

We are currently carrying out an initial evaluation of the system which includes elements of usability and learning success. However, further work will be required to fully test the hypothesis that context-dependent materials in a realistic environment improve learning success.

7. References

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Biography

Christoph Suter is currently working on his Masters thesis, results from which are reported in this paper. He is also an enthusiastic snow boarder.