LEARN – E-LEARNING LESSONS ABOUT AVALANCHES

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ABSTRACT: "Learning by doing" is an obvious credo for every educator. In avalanche terrain, we do this most of the time. However, learning about avalanches also requires some theoretical background as well as guidance on how to apply various tools in practice. To improve avalanche education, we therefore developed e-learning lessons, which motivate users to learn about avalanches by giving instant feedback. The web-based platform White Risk (www.whiterisk.ch) was therefore extended with a forth module called LEARN, offering e-learning lessons of specific well-defined topics. Users are guided through a lesson, focussing on clearly defined learning objectives. The lessons cover topics about avalanche types, avalanche danger degree, slope incline, graphical reduction method, trip planning and risk reduction. Each lesson begins with an exercise to engage the users in the topic at hand. In the second part, called "Info", the essential knowledge on the topic is provided. The user can then apply the acquired knowledge in a variety of exercises, until the skills learned are consolidated. Immediate feedback is given to show which answers were correct or incorrect. Finally, users can run through a 'final' test and receive an evaluation. These lessons do not replace avalanche education in the field. However, they are useful e.g. as preparation for an avalanche course, so that participants bring some basic knowledge to the course and instructors can build upon. The lessons are available in German, French, Italian and English.

KEYWORDS: White Risk, avalanche education, e-learning, avalanche danger assessment, avalanche awareness

1. INTRODUCTION

The majority of avalanche accidents with people involved occur during off-piste or backcountry skiing. A promising way to reduce avalanche accidents is through a combination of appropriate avalanche forecasting and education. The best way to transfer knowledge to the general public is through "learning by doing". Therefor an important part of avalanche education takes place in avalanche terrain. But, learning about avalanches also requires some theoretical background to understand, apply and adapt various tools in the field. Knowing about avalanches means understanding a complex system influenced by the key factors snowpack, weather, terrain and human factors. Thus, specific avalanche knowledge is required. However, dealing with avalanches also requires the ability to recognise and anticipate relevant relations of the key factors and to understand the complex phenomenon "avalanche". In education research this is called system competence (Rempfler and Uphues, 2012).

Rempfler (2010) as well as Schnydrig (2014) showed that this so-called 'systems thinking' is often poor among winter backcountry recreationists compared to the basic knowledge on mono-causal relations (e.g. avalanche danger increases with new snow).

Although basic avalanche knowledge on terrain, weather, snowpack and human factors is essential, the learning process will be improved when important relations among these factors are understood. We then can expect that an enhanced process understanding on avalanches and on avalanche risk management ensues, which has to be practiced over and over and finally appropriately applied in practice.

Many books exist which teach avalanche knowledge for backcountry recreationists (e.g. Munter (2003), Tremper (2008), Harvey et al. (2012)). The recently developed web-based platform White Risk (www.whiterisk.org; Harvey et al., 2013) provides a more interactive way of learning about avalanches by explaining complex processes with intuitive examples to transfer

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scientific/expert knowledge on avalanche danger evaluation (Harvey et al., 2014).

Nevertheless, all this information is presented in a rather standard format and the focus is not really focused on teaching and practicing. We therefore extended White Risk (www.whiterisk.org) with e-learning lessons within a new module called LEARN.

The overall goals of the lessons within this module are:

- Focus on specific and well-defined topics
- Clearly defined learning objectives
- Structured guidance through a lesson
- Instant feedback on users action
- Possibility to practice with exercises and quizzes.

2. METHODS FOR EXERCISES AND QUIZZES

Since we wanted to provide instant feedback for the exercises and quizzes, the variety of the pedagogical methods was limited. We therefore defined four methods which can be evaluated automatically and can be solved from a technical point of view.

2.1 Checkboxes

Checkboxes are used with multiple and single choice options. For multiple options the instant feedback shows whether further choices are necessary to complete the exercise (Fig. 1).

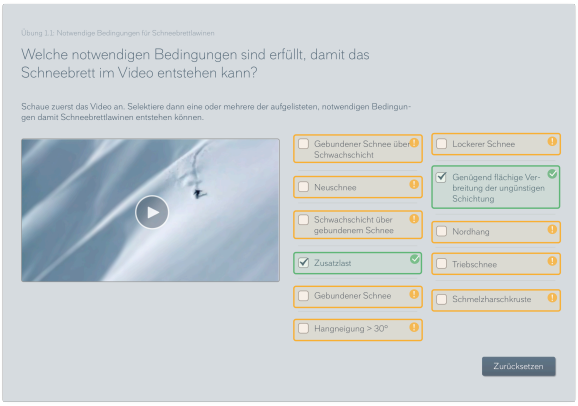

Fig. 1: Feedback of an incomplete multiple choice option.

2.2 Drag and drop

Drag and drop is very common for e-learning lessons. We used this method in various ways:

- Drag several words to single target image.
- Drag single words or images to single target positions in a sentence or an image.
- Drag the same words multiple times to different images or positions.

In the exercises, correctly dragged objects are highlighted in green while wrongly allocated objects flip back.

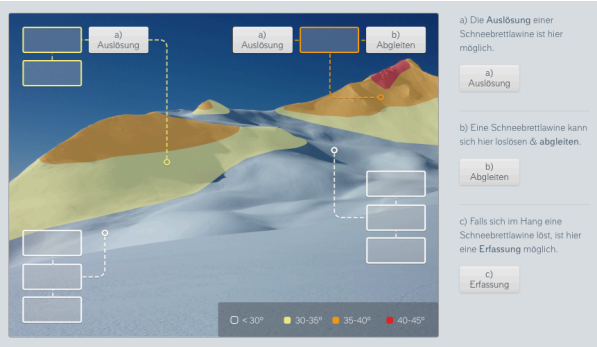

Fig. 2.: Exercise example with drag and drop. The user has to answer 3 questions for the marked locations concerning slope angle and avalanche hazard.

2.3 Sliders

Sliders are used vertically and horizontally. The slider has to be pulled to the approximate correct answer. A defined threshold range determines whether the result is correct or not. As soon as the slider is released in the exercises, it turns either red or green to rate the option chosen (Fig. 3).

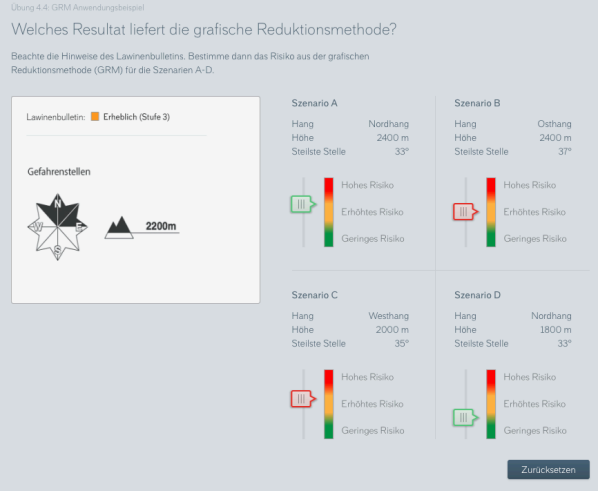

Fig. 3: The user has to determine the resulting risk from the graphical reduction method by pulling the slider to the appropriate position. In this example the green sliders are correct, the red ones wrong.

2.4 Draw a line

This method gives the opportunity to draw a line without any given predefined options. The given straight line can be fitted into an image or a map by moving the defined dots manually. Feedback is given through a defined invisible target layer in the background. Line sections, which lie outside the target area are colored in red (Fig. 4). This method is ideal for trip planning exercises and to learn how to read maps in terms of avalanche hazard.

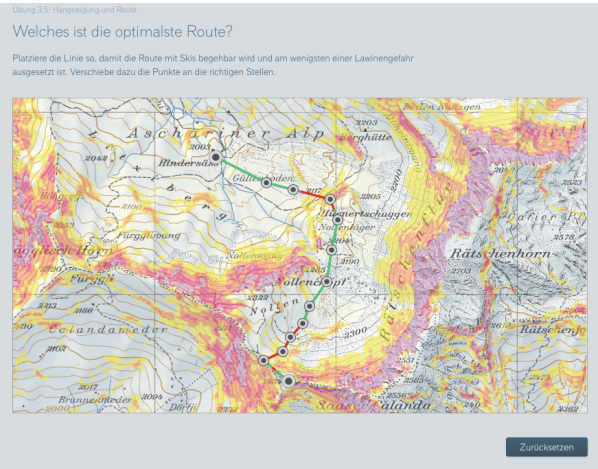

Fig. 4: Example of an exercise for drawing the ideal route on a map. The red sections are not ideal.

3. LESSON STRUCTURE

We developed six lessons, which build on each other. The lessons cover topics on avalanche types, avalanche danger level, slope incline, graphical reduction method, trip planning and risk reduction. Some lessons are specifically focused on novices while others are more demanding for advanced backcountry recreationists.

All lessons have the same basic structure and have one or two clearly defined learning objectives each. The first part of a lesson focuses on learning and practicing new knowledge about the topic. The second part consists of exercises to test the acquired knowledge. This structure is based on research on conceptual change (Vosniadou, 2013) and on concepts how to design and validate learning tasks such as exercises or quizzes (Ralle et al., 2014).

In the following we explain the structure by taking the example of the lesson about slope incline.

Learning objective of lesson 3 about slope incline:

- You learn what slope inclines are relevant for slab avalanches.
- You learn how to measure and estimate slope incline on maps during the planning of a trip and in the field.

3.1 Learn and practice

Each lesson starts with an introductory exercise to inspire the interest of the user for the topic at hand. The exercise is intended to rise questions so the user gets motivated to learn more. Further it rouses existing knowledge and enhances users ability to learn new substance.

Using the example of slope incline the user has to define the affect of slope incline on slab avalanches by drag and drop (Fig. 5).

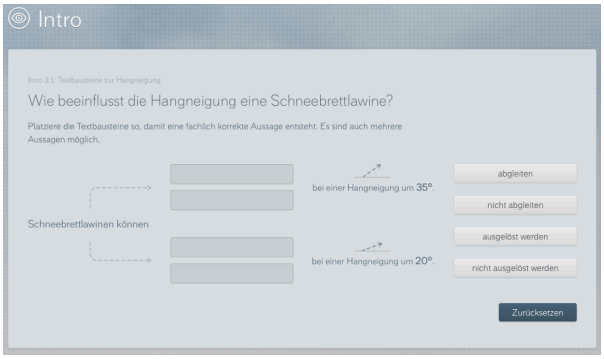

Fig. 5: Example of introductory exercise of lesson 3 about slope incline. The user gets engaged in the topic at hand immediately.

Not until after this introduction, essential knowledge on the topic is provided linked with content from White Risk EXPLORE. This part is called “Information” (Fig. 6)

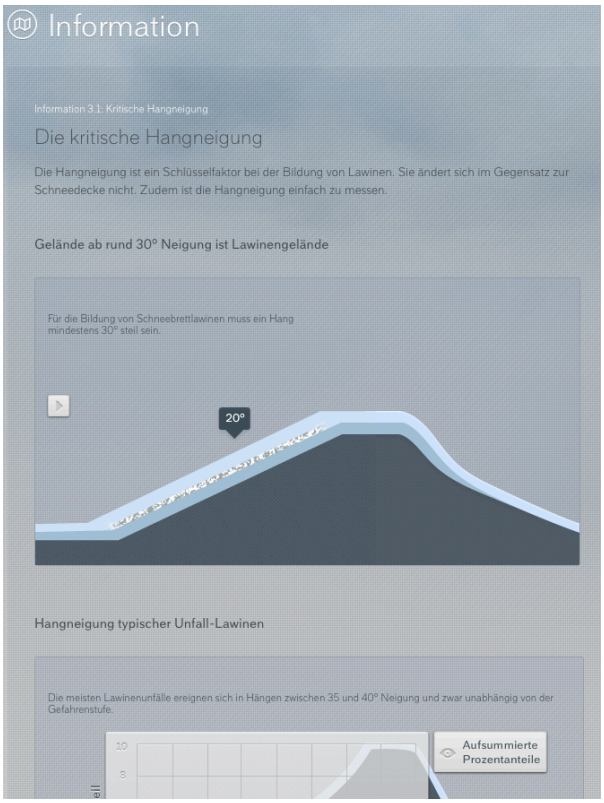

Fig. 6: Example of Information part in lesson 3 about slope incline.

Afterwards, the user can apply his new knowledge in a variety of exercises, in line with the overall goal of ‘learning by doing’. Thus the acquired knowledge gets applicable.

Immediate feedback is given showing which answers were correct and which were not (Fig. 7). Within the six lessons, the user can practice with 33 different exercises.

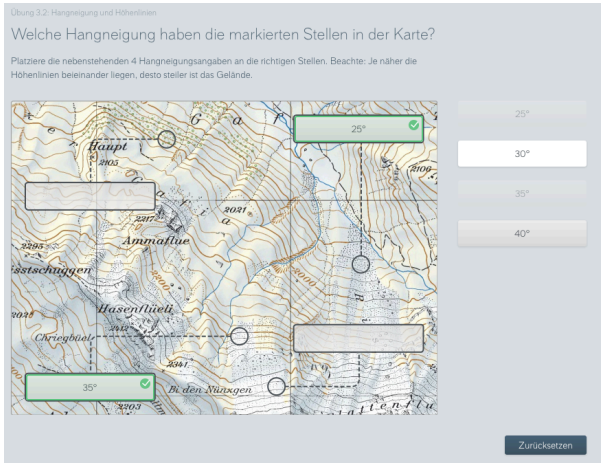

Fig. 7: Example of an exercise in lesson 3 about slope incline. The user has to drag given slope angles to the appropriate location on the map by interpreting the contour lines. Correct assignment turn green, wrong one flip back.

3.2 Test knowledge

Each lesson offers a ‘final exam’ and 34 challenging quizzes have to be solved. The quizzes are similar to the exercises, with the exception that there is no instant feedback. Instead, a final evaluation is given at the end with a summary score and a point score for each test (Fig. 8). The summary evaluation results in ‘passed’ or ‘not passed’.

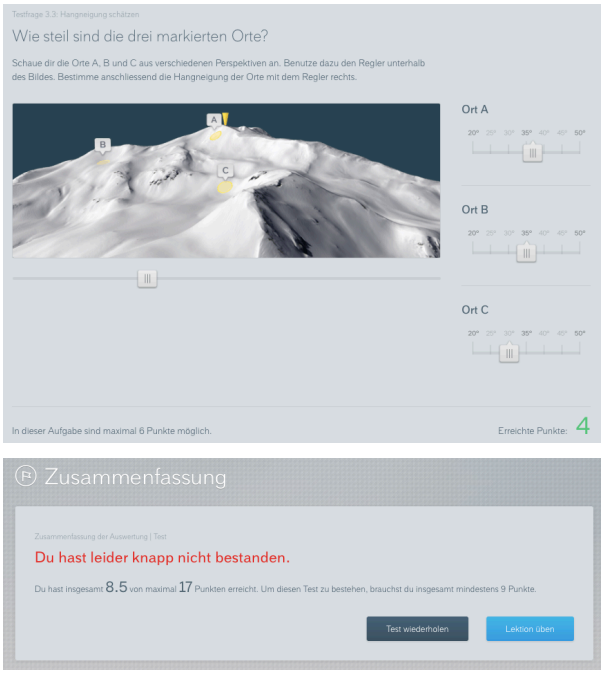

Fig. 8: Quiz example and summary of the test evaluation of lesson 3 about slope incline. Top: Point score for one quiz (4 of 6 possible points were achieved). Bottom. The achieved summary score was just under the threshold to pass the test (8.5 of 17 possible points).

With the knowledge learned earlier in the 'Info' part and from the exercises, the user should have all the available information to pass the 'final exam'.

4. SUMMARY AND OUTLOOK

With the presented e-learning lessons we hope to improve the learning process for winter backcountry recreationists. Thanks to the various exercises and quizzes the users can learn by practicing and improve their avalanche skills. From a didactical point of view it is very instructive to receive instant feedback, which motivates to continue the learning process. Moreover it also prevents from consolidating incorrect knowledge.

Especially personal mental 'models' on the complexity of avalanches risk management can be established and improved. Many exercises and quizzes combine key factors with the goal to better understand the multidimensional complex system 'avalanches".

The presented e-learning lessons certainly allow users to increase their avalanche knowledge by a clear structure and well-defined learning objectives. However, it is clear that web-based tools cannot replace real-life practice in avalanche terrain .

Nevertheless, these lessons can be very useful e.g. as preparation for an avalanche course, so that participants have some basic knowledge on which the instructors can build. They also can serve as a refresher at the beginning of the season. The lessons are available in German, French, Italian and English on www.whiterisk.org. For the future we plan to include more e-learning lessons and guideline on how to include White Risk into an avalanche course.

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