

OVERCOMING AVALANCHE INEXPERIENCE USING ACTIVE EDUCATION

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ABSTRACT: The majority of class time in introductory avalanche courses is spent introducing topics and providing a knowledge base. While important, this highlights one of the common shortcomings in most avalanche courses: it is relatively easy to teach facts, but it is very difficult to teach judgement. The difficulty in teaching judgement is compounded by a number of factors, including the large amount of background avalanche information needed to make a sound judgement, the complexity of each avalanche problem, and differences in how students perceive and respond to risk. Applying active educational strategies can overcome biases identified by behavioral economics to help prepare students in introductory avalanche courses for recreation in avalanche terrain. This paper identifies how incorporating activities with accountability and direct feedback can improve the decision making processes of students in introductory avalanche courses.

KEYWORDS: Avalanche education, flipped classroom, human factors, behavioral economics.

1. INTRODUCTION

Many instructors of avalanche courses have commented on how challenging it is to give students enough knowledge to travel safely in avalanche terrain in the short time allotted for most courses. Students in these courses, especially introductory courses, also express how they wish there was more time for practical application exercises, more types of snowpack to examine, and more practice using the tools they have learned. Indeed it is a difficult task to give students the background information they need to make good travel decisions in avalanche terrain, let alone show those students how to integrate all of the complex information they gather into usable data to make informed choices.

Thankfully, avalanche educators do not need to start from scratch when trying to improve the educational outcomes of their courses. As pointed out by both Geisler (2014) and Gale (2016), incorporating ideas from the behavioral and social sciences can lead to improved educational

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outcomes at a relatively low cost to the avalanche education community. This paper outlines a process to increase the amount of active learning that takes place in an avalanche course while maintaining the quantity and quality of deliv-

ered information. This process is built on the foundation of pedagogical best practices and behavioral economics. It is a flexible framework that can be tweaked to accommodate more extensive topics and larger class sizes, though it is just as effective as a tool for shorter topics and smaller course sizes.

Using the framework presented below has two major pedagogical advantages. The first major advantage is that it maintains – or even increases – the amount of material that a course can cover. Well-designed pre-course activities allow the students to gain necessary background knowledge before the class ever meets. Placing the onus on student to complete the pre-course activities leads to the second major advantage: increased classroom time for application activities. These activities can allow students to make choices using real-world data, but without the potentially fatal real-world consequences.

The remainder of this paper is structured as follows. The first section contains a short review of the behavioral economic basis underlying the need for active learning is presented. The following section gives an overview of the active learning framework, then four sections explain each component thereof. The final section is a brief conclusion that recaps both the important points of implementation and the benefits of using such a framework.

2. BEHAVIORAL ECONOMICS BASIS

The framework presented here helps to overcome some of the cognitive biases identified by Geisler (2014). In particular, active education helps students to compensate for their lack of experience, to better frame their choices, and to encourage the use of decision aids.

The guided practice implicit in active learning helps students to overcome their lack of experience by introducing them to realistic scenarios. A number of papers, including Sitkin and Pablo (1992), Taylor et al. (1996), and Stanley (1997), have shown experience can help novices to objectively improve their decisions.

Well-designed activities can also help students to overcome a number of biases associated with the old 'go/no go' mentality. As pointed out initially by Kahneman and Tversky (1979), presenting a problem in a positive or negative light, even when the outcomes are identical, can change the choice that someone makes. When active education gives students practice framing the travel decision to have positive alternatives it can improve the ability of students to always see good options, even when conditions are potentially dangerous.

Making time for active learning also gives avalanche educators the opportunity to incorporate practice using decision making aids. Simplifying complex information, such as with a decision making aid, can lead to better choices, as pointed out by Charness and Levin (2009). Many such aids exist with respect to avalanches, and having some of these incorporated into course activities can help students to find an aid that makes sense to them. They can then go and more easily use decision aids in the real world.

3. OVERVIEW OF ACTIVE EDUCATION

The key to opening up more time in avalanche courses for applied activities lies in reversing the traditional lecture-then-homework paradigm. This 'flipping' of the usual order of operations is potentially tricky, but with a little planning it can be very successful.

Here is typical plan for a one hour course module:

<i>Component</i>	<i>Time</i>
Pre-course assignment	1 to 2 hours (outside class)
Individual accountability	5 minutes
Team accountability	15 minutes
Leveling lectures	10 minutes
Learning activity	30 minutes

Each of these components are explained in greater detail below.

4. PRE-COURSE ASSIGNMENTS

While one of the major of the benefits of a flipped classroom is the added time for integration activities, it also has the benefit of allowing the student to take her time while learning the background information. People learn at different speeds, and as many avalanche educators have found by experience, an hour-long lecture may only result in students retaining just one or two of many topics presented. Allowing students to work at their own pace while going through the necessary background information – with the ability to go back and re-read or re-watch the material – is extremely beneficial, especially for adult learners.

Assigning focused readings, videos, and targeted follow-up questions helps students to catch the most important points of each reading or video.

5. ACCOUNTABILITY QUIZZES

One of the most frustrating things that an educator can hear from a student at the start of a course is that the student didn't have time to complete the assigned pre-course readings, or that the student did the readings but did not gain much insight from them.

As counter-intuitive as it may seem, having a quiz at the start of a topic can be at least as beneficial as a quiz at the end. This holds students accountable for completing the pre-course assignments by giving them a commitment mechanism. Behavioral economics have shown that commitment mechanisms greatly increase the completion of assigned tasks. See Bryan et al. (2010) for a recent review of the evidence of the effectiveness of commitment devices. It also provides important feedback to the instructors on which aspects of the material that the students had the most difficulty with, which will allow for a focused leveling lecture (discussed in detail below).

In order to get the most benefit, this quiz should include some key components. First, make it short. Quiz only on the absolutely necessary pieces of information. If possible, keep the quiz to just five or ten multiple choice questions. If you think this is way too small, consider how many questions will be completed over the entire course. The National Ski Patrol's (NSP) Level 1 Avalanche Module 1, the classroom component on Avalanche Foundations, has 8 distinct sessions (NSP, 2014). An average of just 7.5 questions per session

would result in students answering 60 questions over the duration of the course! Taken just a handful at a time, these questions can help a student focus on the key aspects of a topic. As Nungester and Duchastel (1982) demonstrated, testing is more effective at encouraging retention of ideas than the equivalent time spent in review.

Just as important as the individual accountability quiz is the team accountability quiz. One reason for such a group activity is to add an additional level of accountability for the pre-course assignments. More importantly, perhaps, the team accountability quiz puts the students in a situation where they have to think a little deeper and justify their answers, resulting in better retention of the material. Those students who know the correct answer in the first place reinforce their knowledge, while others on the team who may be unsure or confused about the topic have the opportunity to hear a peer with a better grasp on the concept explain it, potentially clearing up any misunderstanding.

The nuts and bolts of these two quizzes are relatively simple. First, the student takes an individual accountability quiz of 5 to 10 multiple choice questions. After completing the quiz as individuals, student groups together with 4 to 6 other students to discuss and complete the same quiz as a team. The team must agree on answers, one at a time, to each question in the quiz. As they decide on each answer, they are told whether or not their choice was correct. Instructors may choose to incentivize the group quiz. They may put some sort of prize at stake (from swag to candy to bragging rights), and give three points to each team for naming the correct answer on the first try for each question, two points for the correct answer on the second try, and just one point for the correct answer on the third try. Whichever team gets the highest cumulative score wins.

The rationale for multiple choice questions is threefold. First, it is relatively simple to complete in a short amount of time. Less time on the quiz means more time for activities later. Second, it helps focus the discussion of the team to a few well-chosen alternatives. A well-written multiple choice answer set can stimulate discussion when there are reasons for each answer to be justifiable, even though it may not be the best answer to the question. Third, multiple choice questions are quick for the instructor to grade while students are working on the team quiz. Even grading a small subset of the individual quizzes while the teams work to complete the team quiz will give the instructor val-

uable insight into what areas the students understand well, and which areas need a little more discussion. Once these areas are identified, they can be addressed in a short leveling lecture.

6. LEVELING LECTURES

Because there will inevitably be some aspect of every topic that is a little harder to grasp than others, it is important for the instructors to take a little time to fill in some of the knowledge gaps left after the pre-course assignments and the accountability quizzes. Reviewing the individual and team accountability quizzes gives the instructor a good starting point for to make a few short clarifying comments.

This time can also be used to answer questions that may have arisen as the teams worked on their quizzes. Explaining why one answer was better than another gives the opportunity for the instructor to touch on some of the nuances that mark the complexity of making decisions regarding travel in avalanche terrain.

It is important to remember that this component of active learning is not a lecture in the traditional sense. It is more of a discussion with the class to clear up confusion on just one or two main points that may not have been grasped from completing the pre-course assignment. The main goal of this component is to fill in the last little bit of information that students will need to complete the next component of a flipped avalanche course, the learning activity.

7. LEARNING ACTIVITIES

Now the stage is set – students have been exposed to the background knowledge they need, they have proven they have internalized some of the key components of the background knowledge, and they are actively engaged in a team discussing the topic at hand. They are now ready to start into a hands-on, active learning project. In order to get the most out of a learning activity, a few guidelines should be followed.

7.1 All teams should work on the same problem

Whether interpreting snowpack stability using the stability wheel or selecting safe ascending and descending routes on a topo map, every team should be answering the same question. This allows a comparison of answers in the last 5 or 10 minutes of the activity, which can help students to recognize that complex problems can be correctly approached in many different ways.

7.2 *There need not be a 'right' answer*

The question asked in the learning activity does not necessarily need to have a 'correct' answer. In fact, there may be more than one correct answer, or even no 'right' answer (even though some may be better than others). Given the complexity of integrating all the available data in real-world travel decisions in avalanche terrain it may be beneficial to have at least one activity per course without a clear-cut correct answer.

7.3 *Activities should build on one another*

The instructor should build an intellectual scaffolding for the students to climb, with activities of ever-increasing difficulty being introduced as more and more information is integrated in to the decision-making process. Building the knowledge base and giving students in avalanche courses the opportunity to try in a low-stakes can lead to objectively better decisions when making real-world choices in avalanche terrain. (Geisler, 2014)

One of the toughest tasks for students in avalanche classes, particular in introductory avalanche classes, is to integrate all of their newly-learned knowledge into useful travel advice. By having each activity add complexity, instructors can build the skills of the students to the point where they can start to make sound decisions about travel in avalanche terrain on their own.

The value of integrating the classroom components in realistic active learning scenarios spills over to the rest of the course. A class can then move into the field to start to collect real-world data, and, armed with an understanding of how to integrate these data points, they can immediately see how the classroom and field components fit together.

8. CONCLUSIONS

As avalanche educators work to incorporate this framework into their classes, they should note that this process can be adapted in a number of ways to best fit the goals of each course and each instructor. The framework can be used for just one integrated travel simulation at the end of a course, or it can be used for every session and topic in a course. An instructor may choose to have separate pre-course assignments, accountability quizzes, and leveling lectures for multiple topics, then use just one or two activities that combine the knowledge.

For example, an instructor may choose to have independent pre-course assignments, accountabil-

ity quizzes, and leveling lectures for each of the three sides of the avalanche triangle snowpack, then have an activity that combines these three aspects. One such activity could combine travel planning and route selection using actual data for the local area collected in the prior season. The course could then move on to the accountability quizzes and leveling lecture for human factors, followed by an activity similar to the first which is expanded to incorporate some of the complicating elements introduced by human factors.

In the opinion of the authors of this paper, every avalanche course, particularly introductory avalanche courses, should include a simulated travel planning and route selection activity. This should occur even if the content of the course is not flipped. Such an activity provides vital practice integrating the complex information typically obtained through direct observation: results of snowpack tests, weather observations, terrain analysis, and the ever-present human factors. Guided practice drawing conclusions from all of these data points helps form the experience necessary for making good future choices when traveling in avalanche terrain.

In order to remain relevant, avalanche educators must continuously strive to make their courses as accessible and effective as possible. The above framework is a flexible template to help improve avalanche education by allowing for material to be covered in greater depth and with greater integration than a traditional classroom lecture. The increased active learning that this framework affords can better serve students in avalanche courses, and as a result, can improve both educational outcomes and the choices our students make while traveling in avalanche terrain.

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