STUDENTS' REFLECTIVE EXPERIENCES AND THE DEVELOPMENT OF A STRAEGIC MINDSET FOR DECISIONS IN AVALANCE TERRAIN

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ABSTRACT: Travel in avalanche terrain requires more than technical knowledge of snow, weather, and terrain. Research has repeatedly shown that human factors and decision-making processes play a central role in avalanche accidents. However, these aspects remain difficult to teach and learn, particularly in educational settings where serious consequences cannot be used as direct learning experiences. This paper presents a practical teaching model developed and implemented in a university level avalanche course in Norway. The educational design combines short theory sessions, field-based learning experiences, transparent guiding, and structured reflection. Drawing on Dewey's theory of experiential learning and contemporary avalanche decision-making literature, the model aims to support the development of a strategic mindset among students. The course was conducted over a four month period and involved repeated cycles of preparation, field observations, decision-making exercises, and reflective discussions. Student experiences indicate that the approach helped them move from passive participants to active contributors in group decision-making processes. Transparent guiding, explicit attention to avalanche problems, and post-tour reflection appeared particularly important in helping students recognize uncertainty, articulate observations, and balance personal goals against objective risk assessments. The paper argues that avalanche competence should be understood as a reflective and collective practice rather than simply the acquisition of technical knowledge. Practical implications are provided for avalanche educators seeking to strengthen decision-making skills and communication within educational programs.

KEYWORDS: Decision-making, avalanche education, transparent guiding, strategic mindset, experiential learning.

1. INTRODUCTION

Avalanche terrain represents one of the most challenging environments for decision-making in outdoor recreation. While advances in avalanche forecasting, terrain assessment, and snow science have contributed significantly to risk management, a large proportion of avalanche accidents continue to involve human factors and decision-making errors.

Teaching students to identify avalanche problems is relatively straightforward compared to teaching them how to make sound decisions under uncertainty. Avalanche terrain presents what Hogarth (2001) described as a "wicked learning environment," where feedback is delayed, incomplete, or misleading. Individuals can make poor decisions without immediate consequences and may therefore develop confidence based on luck rather than competence.

This challenge raises important questions for avalanche educators:

> *How can educational programs support the development of reflective and responsible decision-makers in avalanche terrain?*

This paper presents a practical teaching model developed through a university avalanche course in Norway. The model combines theory, field experience, transparent guiding and structured reflection to support the development of a strategic mindset for avalanche decision-making.

2. EDUCATIONAL CONTEXT

The teaching model was implemented as part of a bachelor's degree program in outdoor education at the Western Norway University of Applied Sciences. The course was delivered between January and April and involved eleven third-year outdoor education bachelor students. The overall educational goal was to help students develop

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practical decision-making competence in avalanche terrain through repeated exposure to realistic situations combined with guided reflection.

The instructional design consisted of repeated learning cycles including:

- Classroom preparation
- Tour planning
- Field-based observations
- Transparent guiding
- Group decision-making
- Structured reflection

Rather than treating decision-making as an isolated skill, the course approached avalanche competence as a process involving technical knowledge, situational awareness, communication, and continuous reflection.

3. THE PRACTICAL TEACHING MODEL

3.1 Principle 1: Establishing a focus for attention

Before each field excursion, students were introduced to a specific learning objective connected to the forecast avalanche problem.

Examples included:

- Wind slabs
- Persistent weak layers
- Terrain
- Weather (wind, temperature and precipitation)
- Human-factor challenges

Students were encouraged to formulate expectations before entering the field. Rather than asking students to "observe everything," they were asked to actively search for evidence related to a particular avalanche problem. This approach was inspired by Dewey's argument that meaningful experiences require purposeful attention and inquiry.

3.2 Principle 2: Transparent guiding

Transparent guiding was used throughout the course as a central instructional strategy. Instead of making decisions silently, instructors and participations verbalized their observations, concerns and reasoning processes.

Examples included:

- Why a route was chosen
- What aspects of the snowpack were causing concern
- How uncertainty influenced decisions
- Alternative options being considered

Students were invited to question decisions and contribute their own interpretations of the situation. By making expert thinking visible, decision-making became accessible and open to examination.

3.3 Principle 3: Shared decision-making in the field

Students were gradually given increasing responsibility for route selection and risk assessment. Small groups discussed:

- Terrain choices
- Avalanche problems

- Possible consequences
- Levels of uncertainty

Particular emphasis was placed on encouraging disagreement and constructive discussion. The aim was to move students from being passive followers toward becoming active participants in collective decision-making processes.

3.4 Principle 4: Reflection after action

After every excursion, students participated in structured reflection sessions.

Discussions focused on questions such as:

- What did we observe?
- What surprised us?
- Which decisions proved difficult?
- Which human factors influenced us?
- What would we do differently next time?

Connections were continuously drawn between field experiences and theoretical concepts. Reflection enabled students to reconstruct experiences and integrate new knowledge into future actions.

4. OBSERVED LEARNING OUTCOMES

Although the purpose of the teaching intervention was not to train students to become avalanche experts within a single course, the students described several changes in how they approached decision-making in avalanche terrain. Across interviews, three interrelated developments were particularly evident: increased situational awareness, greater participation in decision-making, and more reflective communication about uncertainty.

4.1 Increased situational awareness

A recurring theme in the students' reflections was the development of a more systematic approach to observing and interpreting avalanche conditions. Prior to the course, several students described looking at snow, terrain and weather as isolated pieces of information. Following the intervention, they reported an increased ability to connect observations to specific avalanche problems and to use these observations as part of an ongoing decision-making process.

This development appears closely linked to the instructional strategy of explicitly identifying a "learning focus" or "today's avalanche problem" before entering the field. Rather than attempting to observe everything, students learned to direct their attention toward particular indicators related to forecast avalanche problems. This aligns with Dewey's (2008) argument that meaningful experience requires purposeful inquiry, where observation is guided by questions and expectations rather than passive exposure to events.

Several students described how discrepancies between expected and observed conditions became particularly valuable learning opportunities. These situations created a need to reassess assumptions and search for additional information. Such experiences are consistent with Dewey's concept of reflective inquiry and may be particularly important in avalanche education, where relevant environmental cues are often ambiguous and incomplete.

4.2 From passive Followers to active Decision-maker

A second finding concerns students' changing roles within decision-making processes. Many participants described a transition from being passive followers of more experienced individuals toward becoming active contributors in route selection, hazard assessment and group discussions.

Avalanche educators have long recognized the challenges associated with authority structures and expert influence in mountain environments. McCammon (2002) identified "expert halo" as one of several heuristic traps that may lead individuals to defer critical thinking and transfer responsibility to more experienced group members. In contrast, the students in this study reported increasing confidence in questioning assumptions, requesting explanations and expressing disagreement when necessary.

This development was particularly evident in relation to the concept of a strategic mindset (Atkins, 2014). Students described how the framework provided an organizational structure that helped them translate theoretical knowledge into practical action. Rather than relying solely on intuition or the judgment of others, they began using explicit decision-making processes to evaluate terrain, snowpack conditions, weather factors and human influences.

The findings suggest that structured opportunities to participate in decisions may support movement from legitimate peripheral participation toward fuller participation within a community of practice (Lave & Wenger, 1991). Students did not merely acquire knowledge about avalanche terrain; they increasingly saw themselves as responsible decision-makers within that terrain.

4.3 Greater awareness of human factors and uncertainty

The intervention also appeared to increase students' awareness of the psychological and social dimensions of avalanche decision-making. Students frequently referenced concepts such as familiarity, scarcity, expert halo and goal fixation when discussing both course experiences and their own recreational skiing practices.

Previous avalanche research has repeatedly demonstrated that many accidents cannot be explained solely through objective terrain or snowpack characteristics. Human factors often play a decisive role in shaping decisions under uncertainty (McCammon, 2002; Landrø et al., 2020). Developing awareness of these influences is therefore a central objective in contemporary avalanche education.

Students described an increased ability to identify situations where personal ambitions conflicted with objective hazard assessments. Several participants referred to an internal "struggle" between the desire to reach a summit and the need to make conservative decisions. Interestingly, the students often framed this struggle as a normal and expected aspect of travelling in avalanche terrain rather than as a sign of poor judgment.

This finding resonates with Atkins' (2014) description of avalanche decision-making as a dynamic interaction between intuitive and analytical thinking. Rather than eliminating emotions, motivations or desires, effective decision-making requires recognizing and managing their influence.

4.4 Communication and transparent guiding as learning tools

Perhaps the most significant outcome of the intervention was the role communication played in both learning and decision-making. Students consistently highlighted the value of transparent guiding, where instructors openly verbalized observations, concerns, uncertainties and decision rationales.

By making expert judgment visible, transparent guiding appeared to reduce the distance between instructor and student. Rather than observing only the final decision, students gained access to the reasoning process that produced it. This supports Løvoll and Einang's (2022) understanding of transparent guiding as a practice that combines leadership with openness, dialogue and shared responsibility.

The students also described how speaking openly about uncertainty became increasingly normalized throughout the course. Discussions about alternative interpretations, incomplete information and potential errors were not viewed as indicators of weakness, but as essential components of effective decision-making. This is particularly important in avalanche terrain, which can be characterized as a wicked learning environment where feedback is often delayed, ambiguous or misleading (Hogarth, 2001).

Furthermore, transparent communication appeared to strengthen collective decision-making. By verbalizing observations and concerns, students transformed individual perceptions into shared group knowledge. This process enabled group members to challenge assumptions, detect overlooked hazards and develop a more comprehensive understanding of the situation.

Taken together, these findings suggest that communication is not merely a mechanism for sharing information. Rather, communication functions as a cognitive and social tool that supports reflection, accountability and collective sense-making in complex and uncertain environments. Through repeated cycles of transparent guiding, shared decision-making and structured reflection, students appeared to develop a more deliberate and reflective approach to avalanche terrain assessment.

5. PRACTICAL IMPLICATIONS FOR AVALANCHE EDUCATORS

Based on our experiences, five recommendations emerge:

1. Make expert thinking visible (Klein, 1997)

Explain decisions while they are being made. Do not only present conclusions.

2. Create a specific learning focus

Direct attention toward clearly identified avalanche problems before entering the field.

3. Normalize uncertainty

Model uncertainty as an expected and valuable part of decision-making (Jamieson, et al., 2015).

4. Use small learning groups

Smaller groups encourage participation and increase students' willingness to contribute observations and questions.

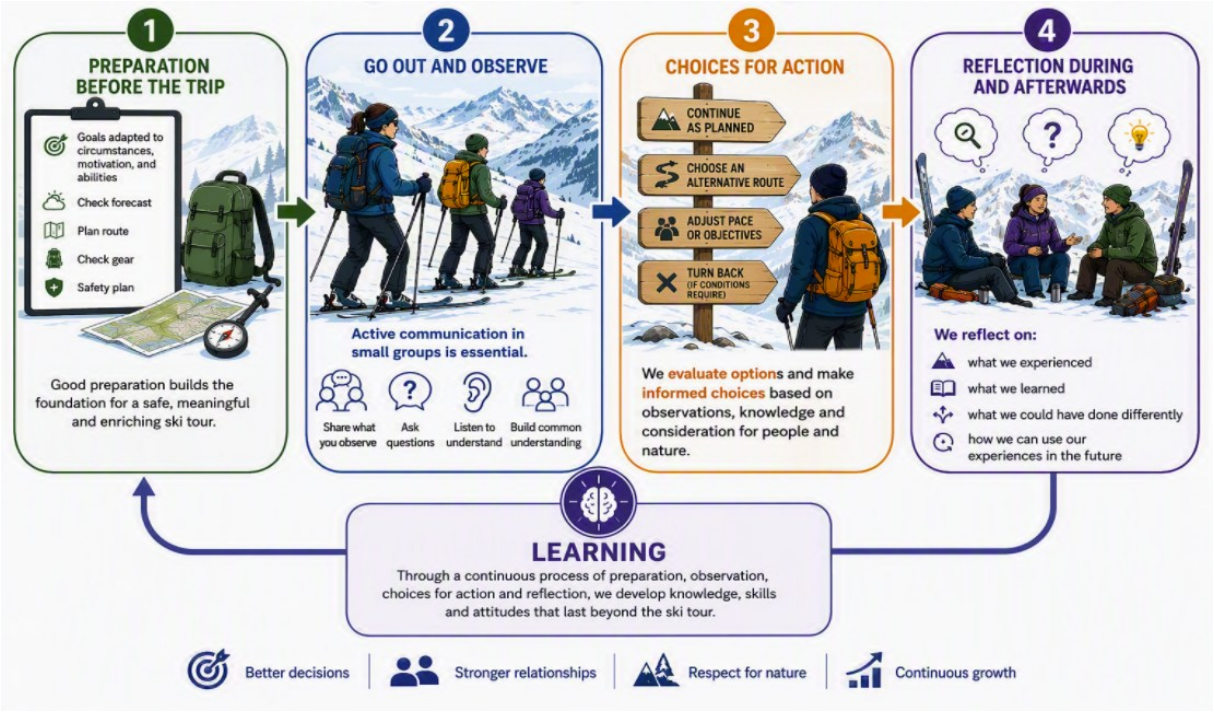


Figure 1: Decision-making and learning during ski touring: A student perspective (Text: Hallandvik & Vikene; layout: Copilot).

6. CONCLUSION

Developing competent travelers in avalanche terrain requires more than teaching snow science and technical assessment tools. Educational programs must also address how people think, communicate and make decisions under uncertainty.

This paper presents a practical teaching model that combines theory, field experiences, transparent guiding and reflection in a continuous learning cycle. Experiences from a university avalanche course suggest that this approach can help students develop a strategic mindset and move from passive participation toward active engagement in collective decision-making.

We argue that avalanche competence is best understood as a reflective practice in which technical knowledge, communication, judgment, and social responsibility are continuously developed through participation in authentic learning environments.

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