UNDERSTANDING GROUP DYNAMICS AND USE OF AVALANCHE FORECAST BEHAVIORS AFTER COMPLETING A RECREATIONAL AVALANCHE COURSE

Kelly R. McNeil[1]*, Jacqueline A. Morgan[1], Emma R. Walker[2] and Liz Y. Riggs Meder[2]

[1] Eastern Oregon University, La Grande OR, USA
[2] American Institute for Avalanche Research and Education, Telluride CO, USA

ABSTRACT: A growing number of people are venturing into the backcountry each year. Many of these individuals are participating in formal avalanche training. However, little is known about the impact of avalanche education on participants' post-course behaviors. The study aimed to understand participants' use of the avalanche forecast behaviors and reported group dynamics after completion of a recreational-level 1 avalanche course. During the 2021–22 season, a 29-question retrospective pretest-posttest survey was used to gather individuals' perceptions of their behaviors during three time periods. The survey was distributed via email to all students who had taken the course during different time intervals; 6 weeks (winter 2022–23), 1 year (winter 2021–22), and 2 years (winter 2020–21). The survey consisted of 6 sections: 1) demographics, 2) group dynamics, 3) backcountry behaviors before and after the course (before leaving the trailhead when planning your backcountry trip, when out traveling in the backcountry), 4) use of the avalanche forecast after the course, 5) incidents and near misses, and 6) beliefs about the course. Sections 1 and 3 were presented in a previous paper (McNeil et al, 2023). This paper will focus on participants' use of the avalanche forecast after the course and group dynamics. The majority of participants stated they check the forecast ahead of every trip or ahead of every trip and sometimes in between trips. The most frequent sections of an avalanche forecast checked by participants were danger rating, bottom line, and avalanche problem. The least checked were public observations and social media posts. The majority of participants stated the forecast strongly influenced their terrain options. Most respondents travel in groups of 3 to 4 people and most participants never travel alone. Participants reported they are often part of a small group that makes decisions collectively. Results from this study help us understand group dynamics, and use of the avalanche forecast of participants after taking an avalanche education course. This understanding can enable educators, forecasters, practitioners, and researchers to gain insight into the backcountry behaviors of avalanche course participants.

KEYWORDS: Avalanche education, behaviors, group dynamics, avalanche forecast.

1. INTRODUCTION

Participation in winter recreation has been increasing since 1995 (Birkeland et al., 2017); contemporarily, Valle et al. (2022) found that backcountry travelers noticed more people in the backcountry during and after the COVID-19 pandemic. Engaging in winter recreation in avalanche terrain carries inherent risks and poses a threat to individuals venturing into the backcountry. Over the period from 2013 to 2023, a total of 367 avalanche-related fatalities were documented in North America, as reported by

Avalanche Canada (2023) and the Colorado Avalanche Information Center (CAIC) (2023).

1.1. Recreational Avalanche Education

Avalanche education for recreational travelers aims to enhance individuals' knowledge, awareness, and skills, as well as influence practices that promote safer winter backcountry behaviors. These include pre-trip planning with hazard information from experts such as a public avalanche forecast, observation, communication and group dynamic behaviors while traveling in the backcountry, and reflection and continued learning that happens after and between trips. Research specifically addressing the impact of avalanche education on post-avalanche-course behaviors continues to be limited. McNeil et al. (2023) examined the impact of avalanche education on backcountry travel behaviors before and after participation in avalanche courses, finding that courses do influence students' perceptions of their behavior.

* Corresponding author address:
Kelly McNeil
Health and Human Performance
Eastern Oregon University
One University Blvd,
La Grande OR 97850;
tel: +1 541-963-3413;
email: krice@eou.edu

1.2. Study Aims

This study examines the influence of avalanche education on participants' group dynamics and decisions and how participants use and understand the avalanche forecast at 6 weeks, 1 year, and 2 years after completing a Recreational Level 1 Avalanche Course.

2. METHODS

2.1 Instrumentation

A retrospective pretest-posttest design, employing an electronic format, was implemented to gather individuals' perceptions of their behaviors before and after participating in the program. The 29-question survey consisted of 6 sections: 1) demographics, 2) group dynamics, 3) backcountry behaviors before and after the course (before leaving the trailhead, when planning a backcountry trip, during travel in the backcountry), 4) use of the avalanche forecast after the course, 5) incidents and near-misses, and 6) beliefs about the course. This paper focuses on Sections 2 and 4. Specific questions concerning the use of avalanche forecasting ask participants how often they read the forecast after their course and to identify how often they look at specific sections of the avalanche forecast (danger rating, bottom line, avalanche problem, forecast discussion, public observations, social media posts by forecasters, or read the whole forecast top to bottom). In addition, participants were asked if the avalanche forecast influenced terrain options or travel plans. Concerning group dynamics, students were asked about group size, group decision-making (personal role in a group), and confidence in speaking up in a group. For specific methodology, survey face validity, factor loading, and internal consistency, refer to McNeil et al., ISSW 2023 paper.

2.2 Participants

The American Institute for Avalanche Research and Education (AIARE) develops avalanche education curriculum and disseminates the curriculum to avalanche education providers in the US. During the 2022–23 winter, surveys were sent to all AIARE Recreational Level 1 students from the current and past two seasons.

Participants were sent surveys at 6 weeks (took course in winter 2022–23), 1 year (took course winter 2021–22), and 2 years (took course winter 2020–21) after their course participation. Respondents were categorized into three groups. Group 1 comprises AIARE students who completed the course approximately six weeks prior. Group 2 comprises AIARE students who completed the course approximately one year prior. Group 3 comprises AIARE students who completed the course approximately two years prior (see Table 1).

Table 1: Categorization of responses into groups.

	Group 1	Group 2	Group 3
Time post course	6 weeks	1 year	2 year
Winter	2022-2023	2021-2022	2020-2021

2.3 Data Collection

Below is a synopsis of the data collection. (For more detailed information on data collection, refer to McNeil 2023.) Surveys were distributed via email from December 2022 to June 2023 to all students who had completed a recreational avalanche course either 6 weeks (mean duration of 6.18 weeks), 1 year (equivalent to 58.16 weeks), or 2 years (mean duration of 109.99 weeks) prior (see Table 1). The survey response rates for winter 2022–23 were: for the 6-week period, 608 of 9,753 respondents participated, representing a response rate of 6.23%. For the 1-year interval, 644 of 10,931 respondents participated, resulting in a response rate of 5.89%. In regards to the 2-year survey, 441 of 14,013 respondents participated, yielding a response rate of 3.15% (see Table 2). All surveys were anonymous and confidential. The survey was approved by the Eastern Oregon University Institutional Review Board.

Table 2: Response rates for participants.

	Responses	Winter	Response Rate	Mean wks	Cleaned	TOTAL Response Analyzed
	N	Year	Total (%)	Weeks	Deleted	N
Group 1	608	2022-2023	608/9753 (6.23%)	6.18	112	496
Group 2	644	2021-2022	644/10,931 (5.89%)	58.16	94	550
Group 3	441	2020-2021	441/14,013 (3.15%)	109.99	63	378

2.4 Analysis

All statistical analyses were performed using SPSS. Descriptive statistics were employed to determine the frequency of group demographics for the three survey groups. A Kruskal-Wallis was employed to compare differences in response rates of the use of avalanche forecasting sections between the three survey groups. A Kruskal-Wallis was also conducted to determine group differences in confidence levels of group travel based on the number of winters traveling in the backcountry. When significant main effects were found, *post hoc* pairwise comparisons with a Bonferroni correction were performed. An alpha of 0.05 was set for tests with a p<0.05 determining significance.

3. RESULTS

3.1 Demographics

A chi-square Goodness of Fit test was used to examine if survey sample groups were proportionally similar to the total population of AIARE course participants (*see Table 3*). No significant differences in population demographics (Mode of Travel and Gender Identity) were found for Group 1 (p>0.05), Group 2 (p>0.05), or Group 3 (p>0.05) when compared to the total population. The mean age of all student participants is 42 years old, with the majority of students having spent 2 to 5 winters in the backcountry (all students = 44.89%, Group 1 = 48.99%, Group 2 = 67.45%, Group 3 = 75.40%). The sample is composed of mostly males (all students = 64.21%, Group 1 = 67.03%, Group 2 = 67.03%, Group 3 = 66.40%). The majority of participants used skis as their mode of travel (all students = 62.21%, Group 1 = 65.38%, Group 2 = 64.91%, Group 3 = 71.96%).

3.2 Use of Avalanche Forecast

Participants were asked how often they viewed their local avalanche forecast post-course. The majority of participants stated they check the forecast ahead of every trip or ahead of every trip and sometimes in between trips (Group 1= 74.9% (n=326), Group 2 = 78.0% (n=327) and Group 3 = 79.7% (n=206)). (See Figure 1)

**Figure 1: Frequency participants report checking the forecast after the course.**
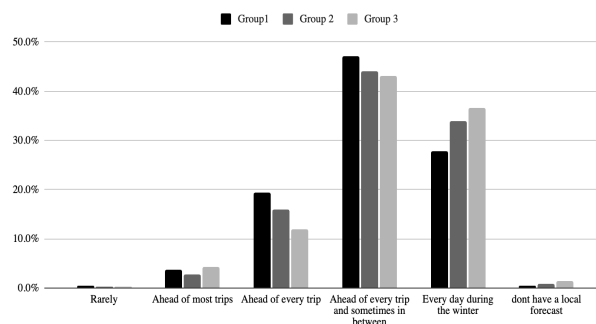
Participants were asked to identify how often they looked at specific sections of the avalanche forecast. These sections included: 1) danger rating, 2) bottom line, 3) avalanche problem, 4) forecast discussion, 5) public observations, 6) social media posts by forecasters, and 7) read the whole thing from top to bottom. The most frequent sections checked by participants were danger rating ((Mean (Std): Group 1= 4.91(0.43), Group 2 = 4.91(0.041)and Group 3 = 4.94(0.43)), bottom line (Group 1= 4.76(0.72), Group 2 = 4.71(0.75) and Group 3 = 4.71(0.75)), and the avalanche problem (Group 1= 4.82(0.6), Group 2 = 4.8(0.59) and Group 3 = 4.75(0.75)). The least checked were public observations (Group 1= 3.59(1.16), Group 2 = 3.65(1.13) and Group 3 = 3.68(1.16)) and social media posts (Group 1= 2.91(1.44), Group 2 = 3.06(1.41) and Group 3 = 3.2(1.37)). Group 1 reported checking social media posts by forecasters significantly less frequently than Group 3. There was no significant difference between the three groups in the frequency of different sections of the avalanche forecast. (See Table 4 and Figure 2.)

Table 4: Frequency with which participants looked at specific sections of the avalanche forecast.

Sections of Avalanche Forecasting	Group	N	Mean (Std)	Mean Rank
Danger Rating	1	489	4.91(0.43)	695.69
	2	546	4.91(0.041)	701.92
	3	372	4.94(0.43)	717.98
Bottom Line	1	487	4.76(0.72)	716.76
	2	545	4.7(0.79)	694.59
	3	372	4.71(0.75)	695.42
Avalanche Problem	1	488	4.82(0.6)	714.97
	2	545	4.8(0.59)	703.13
	3	372	4.75(0.75)	687.11
Forecast Discussion	1	488	4.5(0.89)	736.95
	2	545	4.37(0.99)	685.3
	3	372	4.38(0.97)	684.39
Public Observations	1	487	3.59(1.16)	683.83
	2	544	3.65(1.13)	707.1
	3	373	3.68(1.16)	720.17
Social Media Post by Forecasters	1	486	2.91(1.44)	*661.98**
	2	543	3.06(1.41)	703.72
	3	370	3.2(1.37)	*744.48*
Read the whole thing top to bottom	1	486	3.71(1.21)	723.21
	2	544	3.63(1.22)	692.18
	3	371	3.62(1.19)	684.84

Figure 2: Percentage of participants who report always checking the different sections of the forecast.
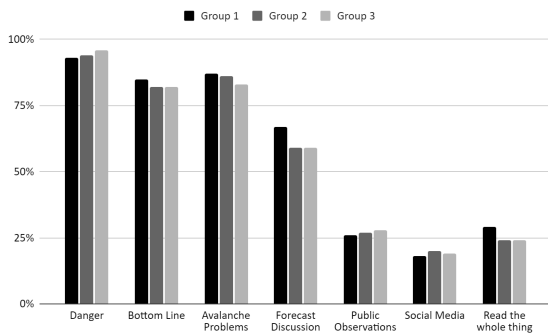
In addition, participants were asked if the avalanche forecast influenced terrain options or travel plans. A 5-point Likert scale from "strongly influence" to "does not influence" was provided. The majority of participants stated the forecast strongly influenced their terrain options (Group 1= 80.4% (n=399), Group 2 = 76.7% (n=422), and Group 3 = 80.2% (n=303)). In addition, participants stated that they created a travel plan based on the forecast. (Group 1= 77.4% (n=384), Group 2 = 69.3% (n=381), and Group 3 = 77.8% (n=294). (See Figure 3.)

Figure 3: Influence of avalanche forecast.
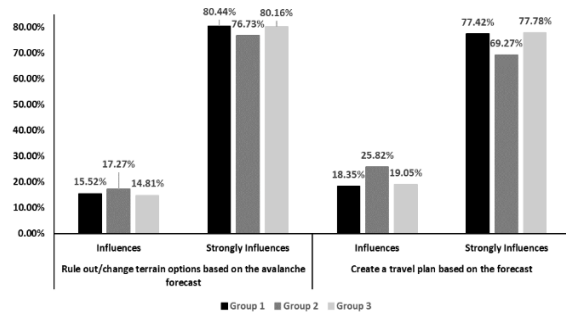
3.3 Group dynamics

The majority of respondents travel in groups of 3 to 4 people (Group 1= 46.8% (n=230), Group 2 = 49.54% (n=270) and Group 3 = 45.62% (n=172)). Most participants never travel alone in the backcountry (Group 1 = 50.21% (n=241), Group 2 = 49.25% (n=262) and Group 3=45.80% (n=170). When asked about group decisions Group 1 (50.8% n=243) and Group 2 (66.43% n=248) answered they are seldom/sometimes the primary decision-maker in the group, whereas Group 3 post-course are more likely to be the primary decision-maker (60.05% n=221 sometimes/often). The majority of participants in all groups reported they are often part of a small group that makes decisions collectively (See Figure 4, Figure 5, and Figure 6.)
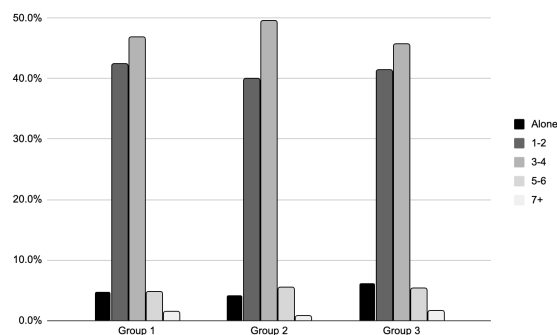
Figure 4: Group size post-course.

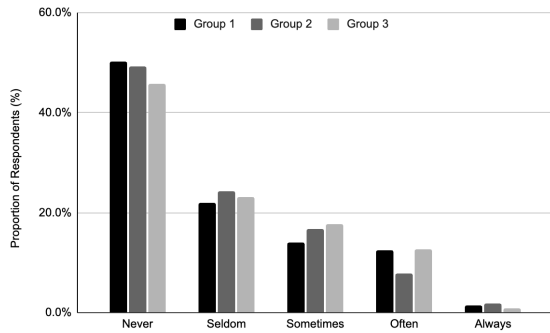**Figure 5: Typically travel alone and make all the decisions.**

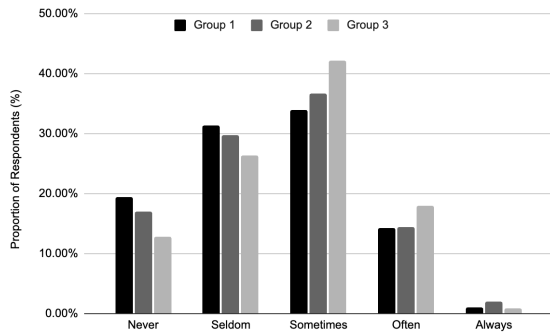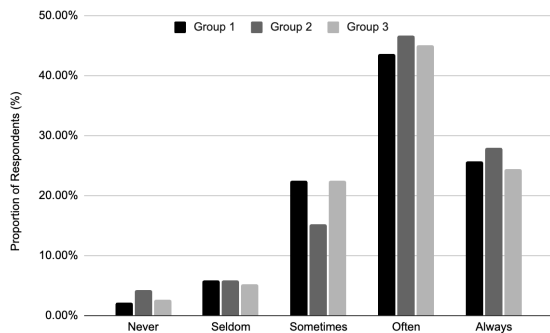**Figure 6: Primary decision-maker in the group.**

Figure 7: Part of a small group of individuals who make decisions together.

4. DISCUSSION

The current study examined the influence of avalanche education on participants' group dynamics and decisions and how participants use and understand the avalanche forecast at 6 weeks, 1 year, and 2 years after completing a

Recreational Level 1 Avalanche Course. Results from this study provide important insight into what students perceive they are doing after an avalanche course. Future research comparing the objective and subjective frequency of behaviors could provide important information on what recreational participants think they are doing and what they are doing.

4.1 Avalanche Forecast Usage and Application

A key learning outcome of recreational Level 1 avalanche courses is for travelers to check their local avalanche forecast and to use the information to manage their exposure to avalanche hazards by choosing where and where not to go (A3, 2024). The risk management informs students to pay attention to avalanche conditions throughout the season, as well as make terrain choices based on the public avalanche forecast before going out (AIARE, 2021). Participants in this study state that they check the forecast before every trip and sometimes between trips, as well as that the forecast strongly influences their terrain choices and helps them make a plan. This indicates students believe they are checking the forecast after Level 1. It is noteworthy that close to 80% of students in all three groups travel less than 10 days a year in the backcountry. Thus, even if students are checking the forecast before every trip it may be less than 10 times a winter. These results do not explore student's understanding of or ability to apply the information from the forecast.

St. Clair, Finn, and Hageli (2021) propose an avalanche forecast user taxonomy based on the complexity of information understanding of avalanche forecast products, meaning some travelers may only use the danger rating of the forecast, while others use avalanche problems and extend a regional forecast at a slope scale.

The current study shows that participants report looking at the danger rating, the bottom line, and the avalanche problems listed in the forecast. It would be valuable to compare which parts of the avalanche forecast travelers use and compare it to the types of terrain they are using and the frequency of their travel. Future studies that examine understanding of forecast information and application to terrain choice such as the

work done by Finn (2020) before and after Level 1 education could help educators and avalanche centers better understand the specific impact of education and outreach on terrain choice in the backcountry.

It is interesting to note that survey respondents report a low frequency of use for social media or consider avalanche forecast posts as part of the avalanche forecast. In 2023, 83% of US adults use YouTube, and 68% use Facebook (Pew, 2024), making at least these platforms an opportune place to disseminate information. Avalanche centers increasingly post observations and forecast information on various social media outlets. More research can be done to understand what type of information backcountry travelers typically get from social media and whether this could be an impactful place to share information. This could influence avalanche centers and educators with the type of information shared on social media and how educators train individuals to use this information to continue education, stay abreast of current conditions, or incorporate the information as part of their planning practice. Combined with social media demographic usage, avalanche centers and educators could use this information to better understand where it is most effective to get certain types of information to certain audiences.

4.2 Group Dynamics

Another outcome of avalanche education is to recommend a group size of 3–5 people when traveling in the backcountry. The majority of respondents travel in groups of 3–4 people and most never traveled alone, indicating that educational messaging has been effective for this group.

While the majority of respondents are traveling in groups, it is less clear how the group is making decisions. Most respondents report they are making decisions together with their groups. Group 3 respondents are more likely to report being the primary decision-maker in a group. Respondents in this group took a Level 1 course at least two years prior, which could mean they are more experienced travelers in their groups. Future research is needed to gain an understanding of how people communicate and make decisions about where to go while traveling in groups as well as how they perceive the group is making those decisions.

4.3 Limitations

The study employed a retrospective pre-post test design that attempts to assess perceived changes resulting from program participation without collecting baseline data before program commencement. The research designs rely on the recall frequency of behaviors 6-week, 1-year, or 2-years before and after the course. Retrospective pre-post designs are self-reported surveys and are based on the participant's perceptions of their behaviors. No objective measure of behaviors is observed with this study design, only the participants' perceptions. In addition, participants may exhibit a subject bias since the survey was sent out to assess skills they may be actively trying to improve (Pratt et al., 2000).

The study had a low response rate. The survey was sent out to all participants who had taken a recreation avalanche course via an electronic email. Participants who were more interested and perhaps more invested in their avalanche education may have been more likely to fill out the survey and have a more positive experience with the avalanche course.

Collecting objectives alongside participant survey data could provide important information on what recreational participants think they are doing and what they are doing. In addition, collecting data over time could help to understand what participants retain over a longer time period, as well as what factors might influence behavior retention.

Participants reported a high frequency of checking the forecast and that they used the forecast to make terrain choices. These questions only assess participants' perception of how often they do the behavior and provide no insight into whether they understand what they are looking at and if they can accurately apply the information to correct terrain choices and travel.

5. CONCLUSIONS

The results from this study help avalanche educators understand the audience participating in avalanche education courses, as well as participants' behaviors after their courses and how those behaviors may change over time (at 6 weeks, 1 year, and 2 years after their courses are completed).

Increased understanding of these impacts allows avalanche educators, forecasters, and researchers to develop interventions using best practices from the public health sector to influence positive behaviors. Such initiatives could include further refinement of risk management curricula, communications, and social media campaigns, improvement of avalanche forecast formats and products, and other responsive initiatives that address the areas where participant behaviors are less impacted or not as positively impacted.

CONFLICT OF INTEREST

ACKNOWLEDGEMENTS

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