

## NATIONAL SNOWSCHOOL PROGRAM AND WEATHER STATION PILOT PROJECT

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### ABSTRACT

Winter Wildlands Alliance's National SnowSchool Program introduces K-12 students to the joy of exploring our nation's winter wildlands. A growing national education program utilizing an innovative snow-hydrology curriculum, SnowSchool annually engages over 30,000 participants across 60 sites. However, one potential problem with a field trip program like SnowSchool is little or no connection back to the classroom. The result can be a weak "one-and-done" experiential program that fails to spark further learning. To counteract this trend, Western Wildlands Alliance and the US Forest Service Rocky Mountain Research Station installed a new snowpack monitoring weather station at the Bogus Basin SnowSchool site near Boise, Idaho. The station's online snowpack data and WWA's unique web-based educational activities provided teachers with a classroom resource that transformed learning at SnowSchool from a 1-day outing into a 3-month science exploration. To understand the impact of this pilot project we collected pre/post student science quizzes. Results demonstrated significant gains in student learning. (KEYWORDS: Bogus Basin, Winter Wildlands Alliance, SnowSchool, environmental education)

### HISTORY

Originally, SnowSchool was conceived in 2001 and intended simply to encourage winter recreation. However, as the program expanded, educators discovered that the mountain snowpack is itself a powerful learning environment. Many students have a natural affinity for snow and when given the opportunity to explore their local mountain snowpack on snowshoes their motivation and enthusiasm for learning is significantly enhanced. To further develop the program model and expand the science curriculum, the National Flagship SnowSchool site was launched in 2005 at the Bogus Basin Nordic Center near Boise, Idaho. Initially this nascent pilot program combined snowshoe exploration with winter ecology lessons targeted towards elementary and middle school students. While immediate teacher feedback about the program was generally positive, formal evaluations indicated a common theme: the need for greater curriculum alignment and relevance to formal classroom study.

To address this deficit, the program leadership developed an additional component to SnowSchool in 2008. Working collaboratively with district teachers, City of Boise Environmental Education and Boise State University a program model was developed that incorporates an in-class snow science presentation delivered to students by a local hydrologist. The in-class presentation was designed to align with state and district science curriculum and create an important element of continuity with the snowshoe field trip. This program innovation led to strong praise among teachers and a 400% increase in enrollment between 2005 and 2011. This program design was the subject of a quantitative dissertation (McClay, 2013) conducted at Boise State University. The study results showed significant gains in science learning when classroom learning was combined with the fieldtrip and when students participated in three specific hands-on snow hydrology activities: 1) a snow-pit analysis, 2) a snow water equivalency test and 3) a watershed mapping activity. The current weather station project builds on this previous research and adds to the program model a much-needed follow-up science component. In 2017 the Bogus Basin SnowSchool site engaged 1,900 Boise-area K-12 students.

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## **LITERATURE REVIEW**

The SnowSchool program is rooted in a place-based pedagogical approach that seeks to provide K-12 students with a rich and meaningful context for science learning through connecting experiences in the local environment to classroom curricula. The philosophy of place-based education is based in constructivist learning theory, and a working definition has emerged that emphasizes the following components: 1) a localized context for curriculum in all school subjects, 2) a focus on experiential/hands-on learning and 3) leveraging local community resources to aid the learning experience (Sobel, 2004). These elements are intended to help students construct knowledge based on their interaction with the world around them. Thus, a core component of the SnowSchool program is a snowshoe-enabled excursion into the students' local snow-covered watershed. Additionally, Cox-Peterson et al. (2003) demonstrated that in order for students to show improvement in science learning, field experiences must not simply occur as a walking didactic lecture, but rather it must contain carefully designed experiential elements of physical and social interaction. In the context of SnowSchool specifically, McClay (2013) demonstrated that specifically designed hands-on, minds-on experiential activities conducted in the students' local snow system significantly increase SnowSchool student learning of snow science content. Studies suggest that while classroom teachers often intend to make a connection between settings, only about a quarter of them actually do so in a meaningful way (Griffin, 1994). Thus, implementing learning activities that bridge the gap between field-trip and further classroom exploration are both under-utilized and considered a best-practice in informal science education (Fenichel and Schweingruber, 2010).

## **WEATHER STATION INSTRUMENTS**

The USFS Rocky Mountain Research Station provided the instruments and installation of the weather station. Sensors installed include: gamma ray snow water equivalency sensor, acoustic snowpack depth sensor, temperature (ambient, snow and soil) sensors, anemometer, relative humidity sensor, and a precipitation gauge. Station data was made publicly available online via MesoWest. Access to weather station data is available at [www.snowschoolorg.org](http://www.snowschoolorg.org).

## **METHODS**

Participants in this project completed specific SnowSchool learning experiences during 2016. All students received a 45-minute classroom introduction to basic snow hydrology concepts. During the SnowSchool field trip all students dug a snow-pit (to measure depth), completed a snow water equivalency experiment, created a map of their local watershed and visited the weather station. The treatment group ( $n=19$  6<sup>th</sup> grade students at a Title 1 school) completed a follow-up weather station project referred to as The Snowpack Prediction Contest. This activity challenged students to review historical snowpack data and current conditions in order to make informed predictions about what the maximum snowpack depth reading and snow water equivalency reading would be over the course of the winter at the weather station. Students tracked snowpack online and compared their predictions to other students' predictions. To provide a comparison, the control group ( $n=19$  5<sup>th</sup> grade students at a non-Title 1 school) did not participate in the Snowpack Prediction Contest or any other follow-up activities.

To determine if the new weather station resource enhanced student learning after the SnowSchool field trip a 20 item snow hydrology quiz (see Figure 1) was developed based on revisions to McClay's (2013) Snow Science Knowledge Instrument. Both the treatment group and the control group took the first quiz (Pre-Test) and then participated in the classroom snow science presentation. The SnowSchool field trip followed three days later, and the students completed Post-Test 1 approximately two days later. One month after SnowSchool, the students in the treatment group made their prediction in the weather station enabled Snowpack Prediction Contest. Three months after the field trip, the Snowpack Prediction Contest concluded. Finally, students in both the treatment group and comparison group completed Post-Test 2 in mid-April.

If you collected a container of freshly fallen snow and then let the snow in the container melt, how much water would most likely be in it?

A.  10 to 20 %

B.  60 to 70 %

C.  40 to 50 %

D.  90 to 100 %

If you are measuring the snowpack and learn the snow/water equivalent is 10 inches, then the snowpack depth must be

A. greater than 10 inches    B. the same    C. less than 10 inches    D. none of the above

If you are measuring the snowpack and learn that the depth is 10 inches, then the snow/water equivalent must be

A. greater than 10 inches    B. the same    C. less than 10 inches    D. none of the above

Figure 1. Three example items from the 20 item snow hydrology quiz used to measure student learning

### ANALYSIS AND RESULTS

Student quiz scores were analyzed via paired samples T-test. The treatment group analysis revealed statistically significant gains ( $p < .01$ ) from Pre-Test to Post-Test 1 and Post-Test 1 to Post-Test 2 (see Figure 2). Statistical significance was achieved even though the group size was small. As in the previous study (McClay, 2013) the field trip had the biggest impact on student learning. The significant increase from Post-Test 1 to Post-Test 2 was notable because three months elapsed in-between. Control group analysis revealed statistically significant gains ( $p < .01$ ) Pre-Test to Post-Test 1, and Pre-Test to Post-Test 2 (See Figure 3). A decrease from Post-Test 1 to Post-Test 2 was not significant ( $p > .05$ ).

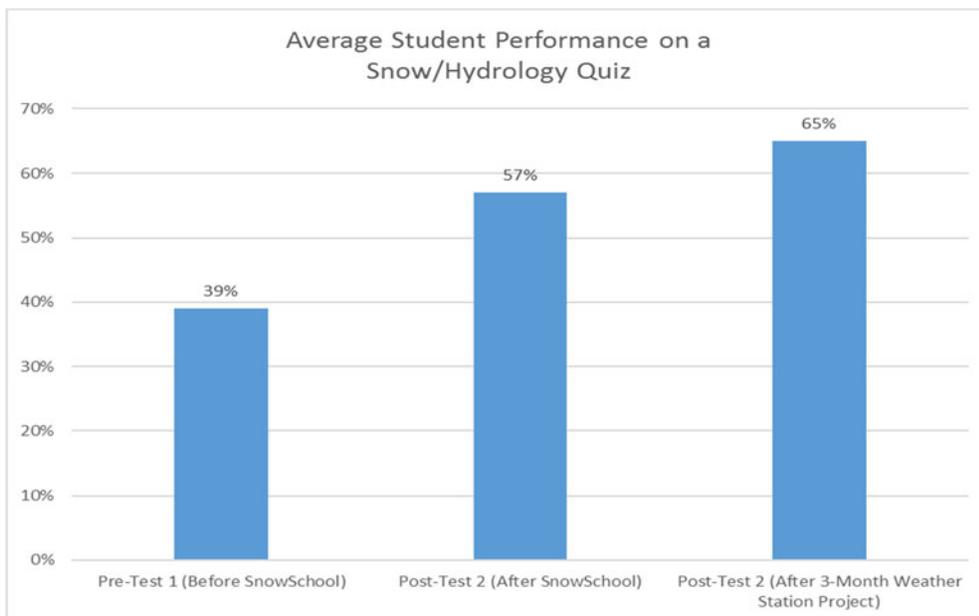


Figure 2. Treatment group results

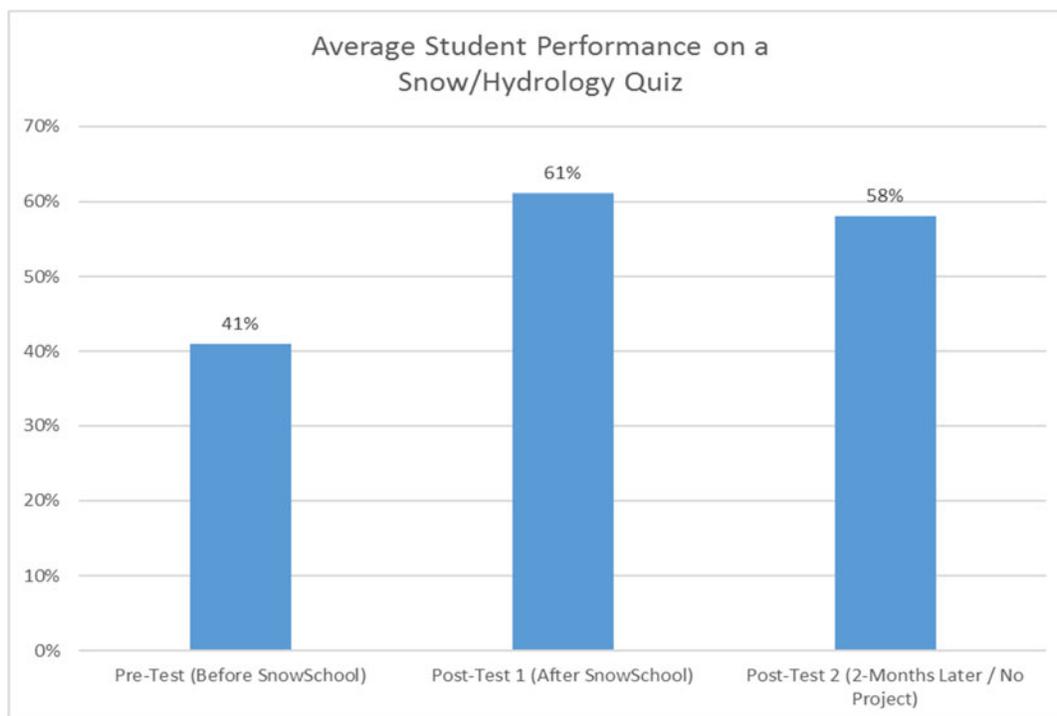


Figure 3. Control group results

### **CONCLUSIONS AND REPLICATION**

The results led to two primary conclusions; 1) the SnowSchool field trip has a lasting impact on student learning and 2) there was significant added value in the weather station follow-up project. Based on the strength of these results Winter Wildlands Alliance moved forward with national replication of this project. Partnering with National Resource Conservation Service Snow Survey, MesoWest, US Forest Service and other organizations Winter Wildlands Alliance created similar projects at SnowSchool sites across the Western US. Ten key SnowSchool sites are actively working to implement the project.

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