Inspiration® SOFTWARE, INC
The Leader in Visual Thinking and Learning™

CASE STUDY

William Diamond Middle School
Lexington, Massachusettes

Massachusetts teacher applies data literacy in and out of the classroom

InspireData™ brings conceptual understanding of data to middle school students and seasoned scientists

Richard Comeau's inquiry-based classroom and hands-on science activities encourage students to arrive at their own understanding of concepts.

Middle school science teacher Richard Comeau has a strategy for keeping his sixth-graders involved in their class work and motivated to find answers to their inquiries. His hands-on physical and earth science courses at William Diamond Middle School in Lexington, Mass., reflect his involvement in scientific endeavors outside the classroom by including extensive data collection and analysis. Through guided discussions, students drive their own inquiry and process of analysis. Comeau uses InspireData™ as a tool to encourage students to form their own questions, collect data, analyze results and make inferences to acquire a deeper understanding of science concepts.

InspireData extends students' understanding of experimental data

Every year, Comeau's students participate in an extended project to learn what it is like to design and conduct a controlled experiment to discover the effects of salt on plant growth. InspireData plays a key role in helping students critically examine different data sets and make valid conclusions.

To begin, students grow their own plants known as Wisconsin Fast Plants (Brassica rapa)—a genetically engineered plant from the crucifer family that completes its entire life cycle in about 40 days. Each student cares for six plants: two plants receive regular tap water, two receive a low-sodium water solution, and the final two are watered with a high-sodium solution. Students use color-coded water bottles and plant trays, together with growing carts and adjustable-height lamps, to avoid errors and control variables.

Students track the growth of each plant, recording plant height, number of leaves, number of flowers, seed pod count and seed pod mass. "My kids get really excited and take great ownership of their plants and the data they collect," says Comeau.

Following completion of the plants' life cycle, students enter their data into an InspireData table and complete a series of exercises to gain an understanding of the graphing process and familiarity with the results of their own experiment. Then, Comeau introduces the concept of large sample size. He aggregates each student's InspireData table into one class data set, setting up the table in a multi-series format so that students can compare their own results to the rest of the class and observe changes in the data over time.

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Class	ID	Owner	Condition	Height												Flowers at 18	Leaves at 22	Pods at 40
				2	5	9	12	16	19	23	26	30	33	37	40			
6B	bchs3	bc	High Salt	0	0.3	1	1.3	3.2	5	7.2	8	8.1	8	8	7.9	10	3	8
6B	bchs1	bc	High Salt	0	0.7	1.5	2.2	2.4	2.6							0	0	0
6B	jels2	bc	Low Salt	0	0.3	0.8	1.2	4.9	8.1	9.8	10.5	10.6	10.6	10.6	10.6	8	7	9
6B	jels1	bc	Low Salt	0.1	0.6	0.7	1.1	2.8	6	7.7	7.9	8	8	7.9	7.9	9	2	5
6B	bcs2	bc	Standard	0	0.8	1.3	2.1	7.1	9.7	14.2	15.2	15.3	15.4	15.4	15.3	8	2	9
6B	bcs1	bc	Standard	0.3	1.2	2.1	2.4	3.2	6.9	13.1	14.8	14.9	14.9	14.7	17	3	3	7
6B	bohs1	bo	High Salt	0	1	1.9	2.5	3	3.2							2	5	0
6B	bohs3	bo	High Salt	0	0.7	1.6	2	5.3	7.6	8.8	8.9	8.9	9	9	9	5	4	2
6B	thkls2	bo	Low Salt	0.2	0.3	1.3	1.7	2.2	5.4	9.9	11.6	12.2	12.3	12.3	12.3	12	5	7
6B	thkls3	bo	Low Salt	0	0.4	0.7	1	2.8	8.4	13.3	14.4	14.5	14.6	14.5	14.5	5	6	6
6B	bos2	bo	Standard	0.2	0.6	1.4	3.5	7	8.8							12	0	0
6B	bos3	bo	Standard	0.3	0.6	2	2.5	6.5	11.9	15.7	15.9	15.9	16	16	16	9	4	8

After students enter data from their plant growth experiment, Comeau combines the data into one class data set in InspireData.

Students then switch to InspireData's Plot View to analyze growth and compare individual results with the

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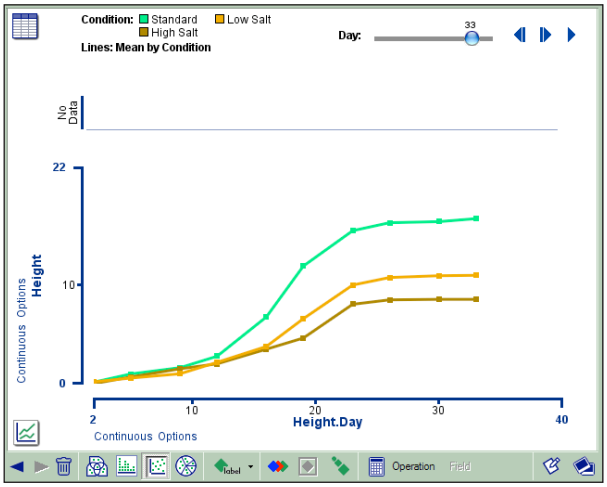
class data. Ultimately, each student is able to track their plants in each salt group within the largest sample size of 170 plants in each group. Using InspireData's Time Series animation, students can track plant height over



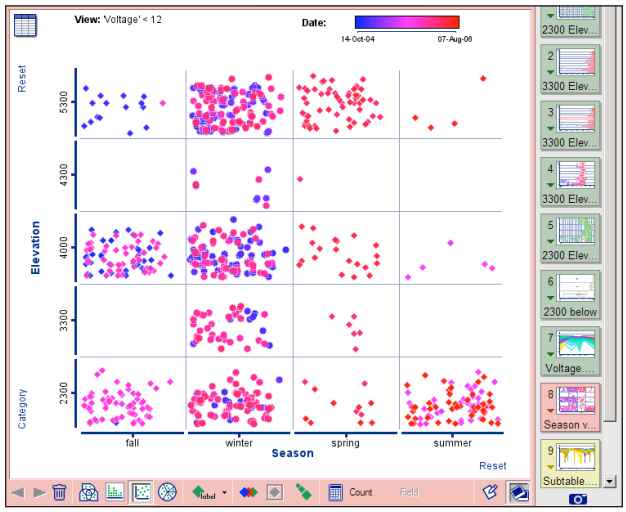
Using InspireData's Time Series animation, students can watch how plant growth changes over time and compare results of treatments.

time with an axis plot and watch as the data moves, showing daily growth. Students can also use other plot types—Venn, pie and stack plots—to compare growth indicators, such as number of leaves, flowers and seed pods. Using the class data set, students draw conclusions about the overall effects of salt on plant growth. "InspireData is fluid and visually engaging. It allows more kids with diverse learning styles to make sense of the data," says Comeau. "Kids want to work with the data because they have so much control over how they represent the information and make sense of it—and they can do it quickly and easily."

InspireData analysis enables conclusions and wows scientists

Comeau also uses InspireData outside the classroom for research and analysis. Last summer, Comeau had the unique opportunity to hone his data analysis skills in a private-industry externship through a Massachusetts Science, Technology, Engineering and Mathematics (STEM) initiative. He spent five weeks at the Mount Washington Observatory, a private, non-profit weather station in New Hampshire. Home to some of the world's worst weather—150+ mph wind storms and temperatures far below freezing—the observatory collects and analyzes data with a mission to advance understanding of the natural systems that create the Earth's weather and climate.

Comeau's task was to analyze data collected from five temperature sensors run by solar-powered batteries located at various elevations on the mountain. The observatory had received a grant to connect additional probes measuring soil temperature, relative humidity and ozone at each site, but scientists were concerned that the batteries were not maintaining the minimum voltage requirements needed to sustain the probes. Since Mt. Washington's extreme weather would prohibit the scientists from making regular visits to each site, the observatory looked to Comeau to investigate why the batteries were not adequate and recommend how to improve each site. InspireData provided him with just the right tool to compile and analyze the data that had been collected over the past 18 months and to enable Comeau to draw accurate conclusions. "I knew all along that I was going to use InspireData for my fellowship to do meaningful work," recalls Comeau.



While working at a weather observatory on a summer fellowship, Comeau used InspireData to analyze and present conclusions drawn from large amounts of data to demonstrate how scientists could improve the observatory's solar-powered, data-collection devices.

Comeau organized the data, which included dates, elevation measurements, voltage readings and sunlight minutes, into several different types of tables in InspireData to find the best method of analyzing the readings and drawing conclusions. He created various plots depicting differences in voltage readings between elevations, seasonal range of sunlight minutes and the voltage variations during different seasons. Other InspireData tools, such as box-and-whisker plots and count computations, provided additional useful information to support his analysis.

Comeau then studied the results of his data analysis in InspireData in combination with site-specific issues and extensive research on solar panels, sun azimuth

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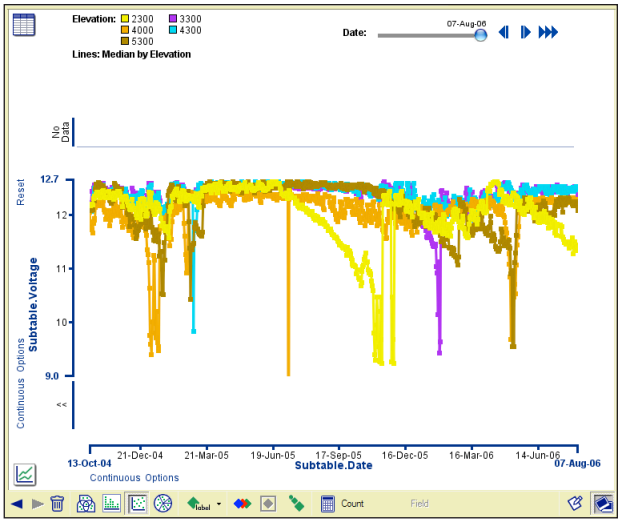
and vertical altitude. As a result, he was able to recommend how and when to adjust the solar panels relative to the ground and the horizon to enable each solar panel to collect enough sunlight to sustain the additional probes. His five weeks of analysis culminated in a presentation to the observatory staff, using InspireData's Slide Show tool to capture the sequence of data analysis and present the live data. "It was wonderful to show scientists at the observatory what InspireData could do," says Comeau. "When I showed the changes over time using the animated time series controls and then exploded the data to show battery voltage changes at each of the sites over the 18 months, that got eyebrows! The scientists appreciated being able to look at the data from so many different angles."

When Comeau returned to the classroom, he showed students his work in InspireData and discussed how his data analysis had challenged assumptions and enabled authentic, meaningful conclusions. He plans to use InspireData for a classroom project that gets students involved in collecting and comparing local weather data to Mt. Washington's. "InspireData is my go-to software," says Comeau. "It is important to get kids to think critically. The construction of knowledge and the corrections of misconceptions take place over time. Powerful learning and deep understanding happen when kids have a chance to make sense of their own data and arrive at their own 'ah-hahs.'"



InspireData's Time Series animation helped Comeau to give scientists a clear picture of the problems and to support his recommendations for improvements.

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