Science:

Science Notebooking in Action: Where Does Condensation Come From?

by Sandy Buczynski and Kristin Fontichiaro

Information Literacy Skills Objectives:

AASL Standards for the 21st-Century Learner:

See "Connecting Science Notebooking to the Elementary School Library Media Center," Table 1, page 27.

Curriculum (subject area) Objectives:

Students will be able to explain that materials, such as water, can be changed from one state to another by heating or cooling.

Grade Levels: 3-5

Resources:

Containers made of glass, metal, Styrofoam, ceramic, and paper
Ice
Water
Soda
Food coloring
Thermometers
Weather forecast showing humidity level

Instructional Roles:

The library media specialist and classroom teacher co-teach this hands-on science inquiry unit. The science notebooking approach (see article, pages 24-27) helps students track their procedural and cognitive thinking. This hands-on inquiry develops the procedural and cognitive skills that can later be used in library research. Throughout, both instructors provide ongoing formative assessment via comments, conferencing, asking questions, and discussion with students.

Activities and Procedures for Completion:

Day 1: Introduction (45 minutes)

The classroom teacher leads a discussion with these questions:

- Does the cup holder in your car get wet when fast-food drinks are stored there?
- Have you ever exhaled on a mirror and seen your breath as water droplets?
- Do your glasses fog up when you go from a cool, dry room to the hot, humid outdoors?
- Does water form on the inside of your windows on a cold day?
- Why do you need a coaster underneath your cold drink?
- Is condensation formed on a water glass the same way that human sweat forms on skin?

The library media specialist records classroom contributions and makes notations on chart paper or a white board for future reference.

Connecting to Science:

Water vapor is water in a gaseous state (humidity). It only condenses (becomes liquid) onto another surface when that surface is cooler than surrounding air. Because warmer air holds more water vapor than cold air, condensation occurs when water vapor in air turns into liquid water droplets due to direct cooling of air. This process is also responsible for formation of clouds.

Inventory Walk:

Students view and discuss the materials available for use in the experiment to engage them in a common vocabulary (see Resources).

Vocabulary:

Some science terms are not represented by physical objects. These words and their definitions continue to develop students' science vocabulary: condensation, water vapor, and humidity.

Day Two: Experimental Design (60 minutes)

Questioning:

Student groups write a measurable question. It is not possible to pre-script this curiosity-driven process. Questions build on students' prior knowledge. Quantitative questions include, "How many/long/often/hot/much/strong?" Comparison questions focus on, "Which would be___?" "What would happen if ___?" Questions that deal with cause-and-effect and problem-solving questions begin with "Can you find a way to…?" or, "How can I…?" Save "why" questions for library research. It is important to note that groups of students will develop different questions to investigate. Some students may wonder, "Which would produce more condensation, a full glass of ice water or a glass half full?," while others may pose, "Which is a more likely surface for condensation: Paper or Styrofoam?" or "How can I stop condensation from forming?"

Formulating a Prediction:

The prediction takes a stand about an experiment's outcome. Students can use this template: "If I change ____, then I predict ____will happen because______." What comes after "because" justifies or explains students' thinking. To serve as an example, we predict: "If blue food coloring is added to ice water in a glass, then the condensation will be blue because water is moving from inside the glass to the outside."

Identifying Variables:

The independent variable is the element that will be manipulated or altered. The dependent variable is what will be measured as a result of that manipulation. Constants are the elements that will remain stable and unchanged throughout the investigation. For our example, students might write:

Independent variable: Adding food coloring to a glass of ice water.

Dependent variable: Measuring the color of the condensation.

Control: Glass of ice water without food coloring.

Constants: Temperature and humidity of room, amount of ice and water in the glasses, measuring instrument.

Designing the Procedure:

Students write step-by-step instructions for conducting the experiment, using imperative sentences for clarity and economy of words. Each group's procedure will be different, depending on the condensation question being asked. For our example:

1. Set up two glasses (#1 and #2) with equal amounts of water and ice cubes.
2. Put two drops of food coloring in glass #2.
3. Record observations of the glasses (baseline data).
4. After 30 minutes, wipe condensation from each glass with a clean paper towel and record color.

	Glass #1	Glass #2
Initial Observations (baseline)	No condensation	No condensation
Color of condensation after 30 minutes	clear	clear

Creating the Data Organizer:

Students need a place to record measurements and data during the experiment. Students design an organizer (T-chart, graph, table) that works for them and draw it in their notebook, such as the example shown above.

Day Three: Experiment and Reflection (60 minutes)

Conducting the Experiment and Recording Data and Observations:

Students follow the procedure, record data in the graphic organizer, and document the process with sketches and written observations.

Claims and Evidence:

Students study the data for patterns that lead to a claim, an assertion based on what they observed. They use evidence, concrete observations, and/or data to support their claim, using the template, "I claim ___________ because _______." For example, "I claim condensation does not come from inside the glass because the wetness outside the glass was clear."

Conclusion:

Students look at their claims and evidence and their original prediction to decide if the claims and evidence support or do not support the original prediction. A sentence frame like "I learned that _______ because ________. My prediction was/was not supported." guides student thinking. Possible experimental error is also discussed in the notebook.

Days Three and Four (60 minutes each)

Project:

Students apply what they have learned to an authentic task: a lab report, or formal paper to the scientific community summarizing their findings. Lab reports have specific formats and use scientific vocabulary. Lab reports are written in third person and succinct (see http://www.geocities.com/chris_castellana/labreport.htm).

Assessment/Evaluation:

Use the Condensation Assessment Rubric to evaluate the lab report (see page 14).

Follow-Up:

Invite students to consider and write down additional hands-on or library inquiry they may wish to pursue about condensation. The library media specialist can suggest expert resources and meet with small groups to facilitate this ongoing learning.

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Note: This lesson plan evolved from a conversation on students' misconceptions with Lisa Baily of Scripts Elementary.

Condensation Assessment Rubric			
	Emerging Scientist (2 points)	**Practiced Scientist (3 points)**	**Accomplished Scientist (4 points)**
Introduction	What did you hope to discover from investigating condensation?	Be sure to indicate your purpose for conducting the investigation.	You clearly state what the investigation is about and give your predicted outcome.
Materials & Method	What did you do? Write a "how to" list of directions including all supplies that will be used.	Remember to give both step-by-step instructions and list materials needed.	Terrific! Another scientist could follow your procedure and repeat this experiment with similar results.
Results & Discussion	What happened? Make sure data gathered is related to prediction so that you draw a valid conclusion.	Think about how you could use charts, tables, or graphs to show data's patterns or trends.	Your data was very organized and easy to read. By making evidence-based claims, your conclusion was valid.
Word Choice	Consider where scientific words could replace common language to indicate the same action/event.	Try defining your scientific vocabulary first and then use it in your lab report.	Great use of science vocabulary in context!
Conventions	Can a friend help you proofread this for next time?	Make sure you spell check your paper!	It's a pleasure to see such great spelling, grammar, and punctuation.

Science:

Science Notebooking in the Library Media Center: Alternative Energy

by Kristin Fontichiaro, Victoria A. Pascaretti, and Sandy Buczynski

Information Literacy Skills Objectives:

AASL Standards for the 21st-Century Learner:

See "Connecting Science Notebooking to the Elementary School Library Media Center," Table 1, page 27.

Curriculum (subject area) Objectives:

Students will identify traditional and alternative energies used in the United States.

Students will discuss advantages and disadvantages of various types of alternative energies.

Students will develop decision-making criteria and use it to determine whether a particular alternative energy is beneficial for local use.

Grade Levels: 5-8

Resources:

Internet resources
Science notebooks

Instructional Roles:

The library media specialist and classroom teacher co-teach this research unit using science notebooking to track students' process and thinking. Throughout, both instructors provide ongoing formative assessment via comments (feedback), conferencing, asking questions, and discussion with students. This lesson is adapted from the work of Swartz (2008) and the science notebooking strategies outlined by Klentschy (2008).

Activities and Procedures for Completion:

Day 1: Awakening Prior Knowledge

In their notebooks, students brainstorm various energies they have observed, energy conservation efforts experienced, and reasons why people might be interested in reducing energy or saving natural resources. Students share their ideas, with the teacher facilitating and the library media specialist recording contributions on chart paper.

These views set context for a scenario: Imagine that the Board of Education must make budget cuts. They will have to dismiss teachers if spending cannot be reduced elsewhere. What kinds of alternative energy could realistically be implemented to save money for the school district?

Connecting to Science

One way to save money in the long term is to decrease our dependence on fossil fuels and other nonrenewable resources, and consider alternative energies. The Natural Resources Defense Council (n.d.) defines "alternative energy" as energy that is typically environmentally sound but has not gained popularity. Alternative energies include wind and water turbines, solar energy, hydroelectric energy, geothermal energy, nuclear energy, hydrogen, ethanol, and biodiesel fuels. Lack of mainstream adoption may be due to start-up costs, initial cost to the consumer for conversion from traditional energy, practicality of use, and aesthetic concerns (e.g., appearance or odor).

Ask students how they can learn about all of these kinds of energy. While a hands-on inquiry could be developed for solar energy, it certainly is not feasible for the study of nuclear energy. This would require library research.

Vocabulary

Students define new words in their notebook glossary as they discover them during research. Their vocabulary may include energy types (e.g., fossil fuel), units of measurement (e.g., barrel or miles per gallon), factors to consider (e.g., renewability or abundance), or specialty vocabulary (e.g., carbon credits or crude oil).

Developing Prior Knowledge

Ask students to search Google News using "alternative energy" as a search term (http://news.google.com) and print a resulting news article that piques their interest. They make notes as they read to summarize information, identify key ideas, develop questions, and make connections.

Working in the Science Notebook Day 2: Pooling Knowledge

Students tape their article printouts into their notebooks. The teacher leads a discussion with question prompts such as: "Does your article discuss an energy that is already being used or just being developed?" "Are incentives offered for using that alternative energy?" The library media specialist records the discussion on the white board. If students express misconceptions, the teacher can quickly skim the article to identify the source and redirect thinking. By pooling their individual reports, students deepen their initial awareness of the extent of alternative energies and discover connections between their news research and that of their peers.

Now students work collectively to make meaning of the data and questions on the board. The teacher uses provoking questions such as: "What were the common hurdles or roadblocks to implementing alternative energies?" "What general applications of alternative energy uses have emerged from the collective articles?" Main ideas will emerge from this consensus building.

Schwarz (2008) identified four major areas for alternative energy research: abundance/renewability, accessibility, production and consumer costs, and safety. Additional considerations may include aesthetic impact, barriers, definition of the energy, or staffing issues. Finally, students select a specific alternative energy to explore in more detail.

Day 3: Preparing for Research

Question

Students begin by writing a measurable research question in their notebooks. For example, "How might _______ energy impact our district?" or "Where has this alternative energy implementation been most effective (success stories from other schools)? Least effective?"

Prediction

A prediction is a student's presumption, recorded in the notebook, about what might be found, supported by prior knowledge. For example, "I think that (alternative energy) will be effective/ineffective because _________."

Data Organizer

In their notebooks, students draw a series of columns across the spread. At the top of each column, students list areas to research (e.g., cost to consumer, cost to produce, barriers, aesthetics). A sample graphic organizer is available online (http://www.ascd.org/ASCD/pdf/el/Swartz%20Matrix.pdf).

Day 4: Procedure

In library research, the library media specialist models these procedural skills:

- ►Selecting appropriate sources.
- ►Organizing digital resources (such as a social bookmarking site; for example, http://del.icio.us/beverlyenergy).
- ►"Reading for research" using types of print, skimming, and scanning.
- ►Verifying information with additional sources.
- ►Documenting references.

Days 5 and 6: Data and Information Collection

Students gather information, recording it in their data chart. Remind students of the objective: to convince the Board of Education that their alternative energy is—or is not—a viable means for long-term money savings for the school district.

Day 7: Making Meaning

Claim and Evidence

After students complete individual research, they share their information on a class wiki, building collective knowledge. (For an example, see http://beverlyenergy2008.pbwiki.com.)

To develop skills in evaluating the relevance or usefulness of a particular piece of information, Schwarz (2008) asks students to code each fact:

* important information
+ advantage
- disadvantage

We add a fourth code:

/ unimportant

Coding helps students identify and evaluate patterns. Overall, is the energy a good match with school district to save money? Or not? This leads to creating a claim along with its justification (evidence). A useful template is: "I claim that [type of energy] is / is not effective for our school district because ____________."

Conclusion

The conclusion is a summary statement written in the notebook that answers two questions: Did the evidence-based claim support the prediction? What scientific knowledge has been learned?

Days 8–11: *PowerPoint* Project

Finally, the student's inquiry converges with the scenario. Working in groups, students carefully consider the audience (Board of Education) and craft a persuasive presentation encouraging the Board to take a particular action. To be persuasive, students must develop a clear position, using specific examples to explain key points.

Assessment/Evaluation:

Assess student work using the "Alternative Energy" Rubric (see below).

Follow-Up:

Invite students to consider and write down additional hands-on or library inquiry they may wish to pursue about alternative energy. The library media specialist can suggest expert resources and meet with small groups to facilitate this ongoing learning.

References:

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Alternative Energy Rubric

Criteria	Points	Student's Self-Score	Teacher's Score
Student completed and coded the data organizer	10		
Student contributed to the wiki	10		
Student worked effectively in a group	5		
The title slide lists names and takes a stand on whether the energy is a good match for the district	5		
Presentation includes each category from data organizer	15		
Presentation is persuasive and takes a stand	10		
Students define and list advantages/disadvantages of alternative energy	25		
Presentation uses bullet points, not full sentences, to support the oral presentation	10		
Each teammate presents a portion of the slideshow with energy and poise	10		
TOTAL SCORE:	100		