Evidence Helps the KWL Get a KLEW

An update on the popular Know-Want-Learn (KWL) chart aligns this favorite teaching tool with the National Science Education Standards.

By Kimber Hershberger, Carla Zembal-Saul, and Mary L. Starr

Many teachers use Know-Want-Learn (KWL) charts and variations of them when teaching science to access students' prior knowledge on a particular topic and help students organize what they are learning during a science lesson or unit. We (a third-grade teacher, a university professor, and a professional development specialist) developed another variation—the Know-Learning-Evidence-Wonder (KLEW) chart—to add to the list. The idea for the modification arose from our observation that many teachers dismiss inquiry as impractical, interpreting science inquiry as "free inquiry," a time in which children pursue questions of their choosing and conduct investigations over extended periods of time—time that is in short supply in elementary classrooms.

We wanted to change that perception and to encourage science inquiry of all kinds (long-term, short-term, open, and guided) in the classroom by highlighting the essential features of inquiry. And, because of the prevalence and popularity of KWL charts in elementary instruction, it seemed like a reasonable and nonthreatening place to start.

Our adaptation differs from the traditional KWL chart because it emphasizes direct observation and using evidence to support what is observed, and it also encourages students to conduct further investigations based on what they observe. These inclusions help the KLEW chart align with the National Science Education Standards, which specifically emphasize the importance of engaging children in scientifically oriented questions, having students give priority to evidence and the development of evidence-based explanations, and justifying their proposed explanations (NRC 2000).

The following is a description of a KLEW chart developed during a unit on air and aviation for third-grade students. Though this example addresses this topic, KLEW charts can be adapted for use with any science topic.

KLEW into the Differences

A traditional KWL chart records what students already *Know* about

a topic, what students *Want* to learn about a topic, and, after explorations, what students have *Learned* about the topic. Similar to the KWL, the purpose of the "*K*" in our modification is to learn what students know of a topic and to use that information to help guide instruction. However, the inclusion of the word "think" in these questions encourages students to share *all* their initial ideas, even those that might not be the "best" scientific explanation (Crowther and Cannon 2004). It also supports the idea that what students think they know can change as a result of the inquiry lessons.

"*L*" stands for "What are we Learning?" Learning occurs by conducting active investigations to find out about a topic. This differs from the traditional KWL because in a KWL, students' "wonderings" occur before investigation and then they conduct investigations and record what they found out in the "L" column. In KLEW, these activities are transposed. Learning precedes "wonderings" or what you want to learn about, which emerge through continued investigation and explanation building.

"*E*" stands for "What Evidence supports what we are learning?" *Evidence* is the data that results from the investigations. In order for students to record a statement under the "L" column, they must be able to provide specific data that supports the statement. This is a significant difference from the KWL—the KLEW chart makes evidence essential to the learning.

Finally, "*W*" stands for the "wonderings" (What new wonderings can we investigate?) that occur as a result of students' investigative activities. Throughout the lesson or unit, students come up with questions and ideas that may further learning. These are recorded in the chart's final column. Emphasis is placed on asking testable questions.

Here's how the KLEW categories played out in the air and aviation unit (see Figure 1, page 52).

What They "K" About Air

Depending on what content is being explored and the time available, completing the "K" section of a KLEW chart can stretch from 10 minutes to a class period or more. Students are asked to share an explanation of the experiences that helped them "Know" the idea they are contributing to the chart. At this point in the unit, it is important to get ideas on paper. Because the KLEW chart is used throughout the unit as each new investigation takes place, students who don't contribute much at this initial time can be encouraged to contribute the next time.

In the aviation unit, the teacher began the unit by asking, What do we think we Know...about air? More than just hearing what students had to say, the KLEW chart provided a record of what students thought as the unit started, which was helpful in understanding what students did not know about air.

For example, students were not familiar with the properties of air necessary to understand flight principles (e.g., air can apply force). Students were also confused about lift and how wing shape and air flow interact to provide lift. The teacher used the information students gave in the K column to tailor subsequent lessons to specifically address student confusion. In addition, she referred to the chart throughout the unit to help students reflect on their growing knowledge of the topic.

"L" with Bags of Air

After completing the "K" column, the students conducted an activity that explored some of the properties of compressed air. Each student was given a quart-size plastic bag securely taped to a straw so that the bag would fill with air when blown into. Students predicted which things in the classroom they thought they could lift with the air in the bag and what they would not be able to lift. Students believed that air could not lift heavy objects, such as a stack of books or a person, but air would be able to lift a piece of paper.

Then, working in pairs, students went around the room and tested their predictions by putting the baggie under the object and blowing into the bag. Students soon discovered that the bag of air could lift much heavier items than they initially predicted, including stacks of books, desks, and an empty aquarium. Students were intrigued and amazed with their findings.

Following the exploration with the bags of air, the teacher gathered students around the KLEW chart to discussion the investigation. The class spent some time talking about and demonstrating some of the things they were able to lift with their bags of air. Then, the teacher asked the students to make a claim about air as a result of their investi-

gation. Students' knowledge claim was that "air is strong," which was then included in the "What are we Learning?" column on the KLEW chart. In this case, students were using the word "strong" to describe the property of compressed air that enables it to hold things up.

"E" is for Evidence

When students made the claim, the teacher asked them to provide evidence ("E") from their investigation that supported the claim. On the KLEW chart, students listed all the heavy things in the classroom that they were able to lift, including their teacher. The teacher then drew arrows to directly link the evidence to the related claim, reinforcing the importance of basing knowledge on evidence in science inquiry.

As the unit progressed, students conducted other investigations related to air and aviation to learn more about air, each time incorporating the use of a KLEW chart into the experience. However, no knowledge claims could be added to the KLEW unless evidence supported that knowledge claim.

After several weeks of air- or aviation-related investigations, class discussions began revealing a group of young scientists that gave priority to data, looked for patterns in those data, and generated explanations that were grounded in data. The children had begun to recognize that "talking science" involved providing support for the claims they wanted to make about phenomena. They were frequently observed launching into a justification of their claims without being prompted to do so.

Figure 1.

KLEW chart created as part of the Air and Aviation unit.

What do we Think we Know?	What are we Learning?	What is our Evidence?	What are we Wondering?
Air is everywhere. Air has oxygen. We need air to live. Airplanes use engines to help them fly.	Air is strong Air takes up space	We lifted a computer, a bin of books, and a teacher with our air bags. When we blew in the bags we could see the air made the bags get larger.	How do jets take off? How many math books can we lift with one bag of air? How many students can we lift using 10 air bags?

What About Wonderings?

"Wonderings"—i.e., questions students asked while collecting data or discussing their results of their investigations—were recorded on the KLEW chart throughout the unit. In addition to recording what she heard students ask during the investigations, the teacher concluded each investigation by asking students if they had more wonderings about the concept under investigation. These "Wonderings" represented the "W" on the KLEW chart.

Wonderings were most often recorded on the chart as testable questions—if necessary, the teacher helped students frame their wonderings as testable questions. Whenever feasible, short lessons or extensions were planned to include the students' questions.

Positive Outcomes

One of the unexpected outcomes of adding evidence to the KWL format was that students began to suggest questions spontaneously as they worked together to construct evidence-based claims. Unlike the kinds of questions students tend to ask at the beginning of a unit, many of the questions generated within the context of investigations and explanation building were testable, such as *How many math books can we lift?* and *How many students can we lift using 10 air bags?*

Connecting to the Standards

This article addresses the following *National Science Education Standards* (NRC 1996):

Content Standards

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry

Science Teaching Standards

Standard C:

Teachers of science plan an inquiry-based science program for their students.

Emphasizing evidence encouraged students to figure out new ways to collect more evidence through scientific investigations. The students were filled with ideas about modifications to existing investigations or designing new tests. Many of these suggestions were included seamlessly in the unit.

The KLEW chart aimed to increase opportunities for inquiry while providing teachers an instructional tool to organize students' ideas about their learning. The KLEW chart did that and more.

After using the KLEW chart throughout the aviation and a few subsequent units, the teacher observed that students wrote with greater depth about science topics. Students frequently referred to the KLEW chart to explain what they learned, and they used specific observations as evidence to support their claims.

We have used the KLEW chart in many settings and with different kinds of learners, including children and prospective and practicing teachers. The feedback is consistent. This new twist on an old favorite has the potential to go a long way toward supporting the vision of reform in elementary science teaching.

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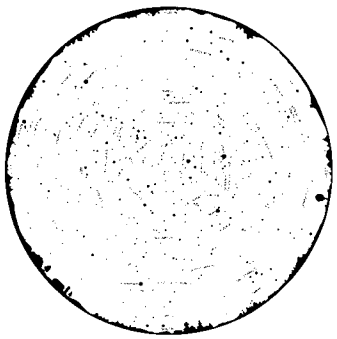
Resources

Crowther, D., and J. Cannon. 2004. From "Know, "Want," "Learned" to "Think," "How," "Conclude," a popular reading strategy gets a science makeover. *Science and Children* 41(1): 42–44.

National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academy Press.

Looking for Evening Skies?



Regrettably, we're no longer including the Evening Skies Monthly Star Map and Sky Calendar in *S&C.*

However, yearly subscriptions to the map and calendar are available from the Abrams Planetarium for $11 and can begin at any point in the year. Go to *www.pa.msu.edu/abrams/SkyCalendar/Index.html.*

Subscribers will be mailed hard copies of three star maps and calendars four times a year to cover the entire calendar year.

Or, check out *http://skymaps.com/downloads.html* for free star map downloads from *StarMaps.com* (permission is required for multiple copies for classroom or science club use).

Last, Skywatcher's Diary *www.pa.msu.edu/abrams/diary.html* posts a monthly detailing of sky happenings.

Happy Stargazing!