

Signing Science!

“Andy and Tonya are just like me! They wear hearing aids and know my language!”

Are these students talking about their classmates? No, they are describing the SigningAvatar characters—3-D figures who appear on the EnViSci Network Web site and sign the resources and activities in American Sign Language (ASL) or Signed English (SE).

During the 2003–04 school year, students in schools for the deaf and hard of hearing participated in the field test of *What's the Weather?* and *Are We Getting the Oxygen We Need?*—two of the signed EnViSci Network units. One group in Grades

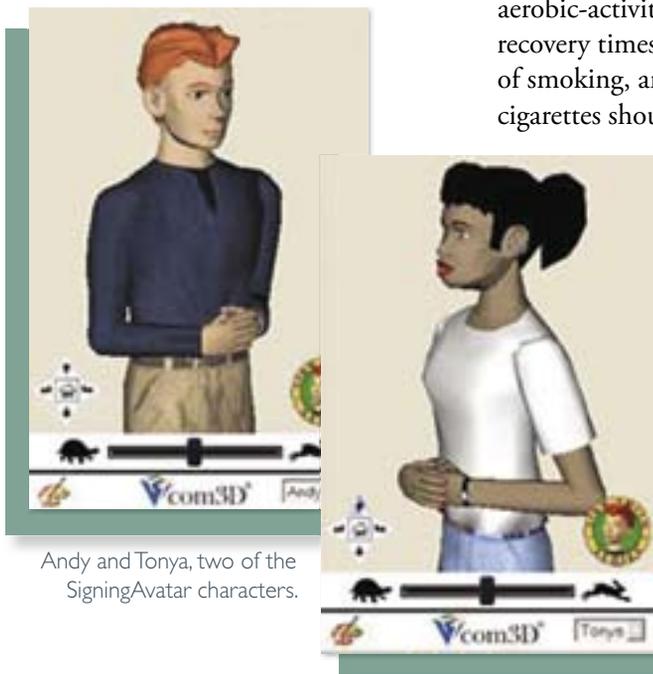
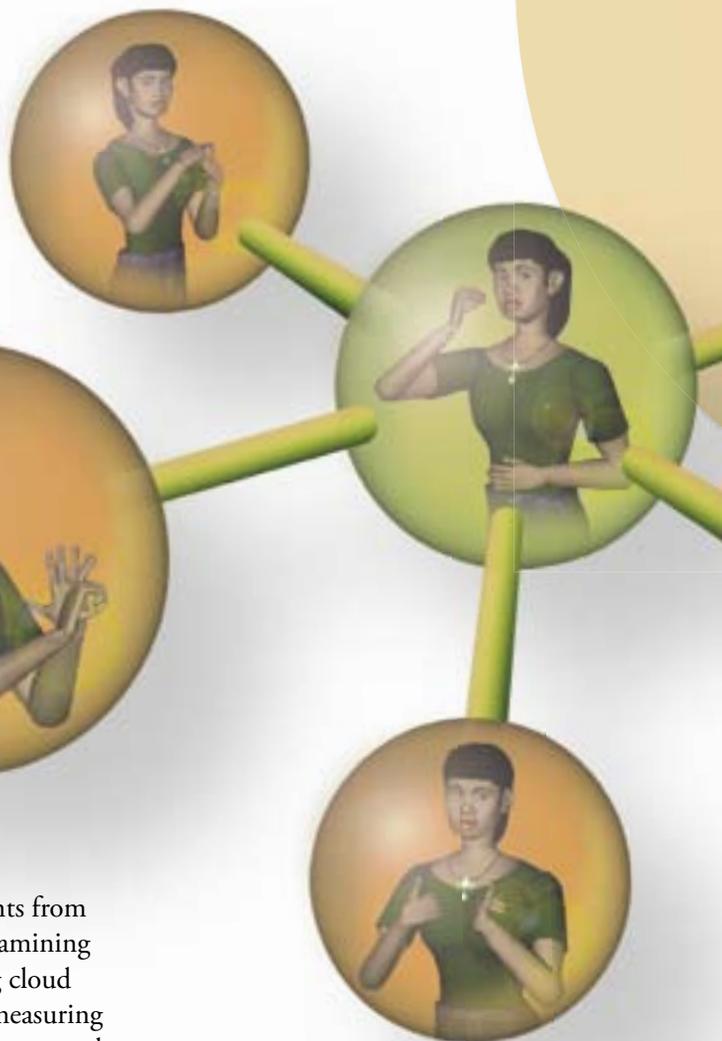
3–6 joined hearing students from Maine to California in examining the water cycle, observing cloud cover and precipitation, measuring humidity and air temperature, and using the Beaufort scale to estimate wind strength. Another group in Grades 5–8 investigated the respiratory and circulatory systems, measured aerobic-activity levels and pulse-recovery times, researched the effects of smoking, and voted on whether cigarettes should be harder to buy.

What Is EnViSci Network?

Developed by TERC and published by Charlesbridge, EnViSci Network is a group of ten standards-based curriculum units for Grades 3–8. Each unit includes a controlled Web site where students can do research and share

their data with a national network of students. After students gather and organize their data, they submit findings to an online database. They then are able to compare it with data from students across the country, expanding the scope of their analysis. Topics for Grades 3–6 include acid rain, tap water, solar energy, trash, and weather. Topics for Grades 5–8 include sound, surface water, soil, polar studies, and body systems.

To make the EnViSci Network materials more accessible to students whose first language is sign, TERC, in collaboration with Vcom3D, is creating a “starter set” of signed units. These units are the same for all students, regardless of whether they are hearing or hearing impaired. All students complete the same hands-on and online activities, send data to a single unit database, retrieve



Andy and Tonya, two of the SigningAvatar characters.



and analyze the same set of student-generated data, and complete the same assessment instruments. The only difference is that the Signing-Avatar characters have been incorporated into the units to make them more accessible to students who are deaf or hard of hearing.

Why Is Signing Needed?

Approximately 50,000 students in the elementary and middle grades who are deaf or have hearing impairments require services under the Individuals with Disabilities Education Act. For these students, many schools implement a bilingual approach that uses sign as the first language of instruction and written English as a second language. However, 90% of the students in this group are

language delayed in the use of signing as their first language. This lack of proficiency seems related to being born to hearing parents who are not proficient in signing and can neither read to them nor interpret written materials in sign. The remaining 10% have well-developed signing skills that seem related to being born to parents who are deaf or hard of hearing and proficient in signing. However, for students in both groups mastering standards-based science content is a significant challenge. They often do not know the signs for the scientific terms encountered or, if they can mimic the sign, do not understand its meaning. This situation is in sharp contrast to the goal of science learning for all students—a fundamental principle underlying the National Science Education Standards and No Child Left Behind.

How Does the Signing Tool Work?

The idea of signing science is simple, the reality effective and engaging. Students go to a Web page and click a Sign It! icon at the end of a text block or on a word highlighted in blue. This calls up Andy, the default SigningAvatar character, to “join their group.” Upon request, Andy or one

of six characters selected from the names in a pull-down list at the bottom of the page signs the text block or a definition in ASL or SE.

What the character signs depends on the students' requests. Students can click the Sign It! Icon, and the character will sign the entire text block. They can attempt to read the text block or definition unsigned and then click the Sign It! icon to have the character sign it for them. They can click on individual words to have the character sign them. To maximize viewing opportunities and meet their needs, students can alter the background color by selecting a color from the palette at the bottom of the page. They can increase the signing speed by moving the “Speed Bar” toward the image of the rabbit. They can decrease the speed by moving the “Speed Bar” toward the image of the turtle. They can zoom in on an Avatar character or zoom out by clicking the arrow pointing up or on the one pointing down. They can rotate the Avatar character to the left or to the right by clicking on the arrow pointing left or on the one pointing right. They can select a different character by highlighting a name in the list. One teacher speaks for many when she says, “My students just love the Avatar characters. They can sign one

By Judy Vesel

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Grades: 3–8 (8–13)

Technology: Internet

Standards. *NETS•S 3, NETS•T II* (<http://www.iste.org/nets/>). *NSES Teaching Standards A, B, C, E, F* (<http://books.nap.edu/html/nses/html/>).

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word or sentence a thousand times over if they want, learn new vocabulary, develop reading skills, master science content, investigate their own questions, test ideas—and all independently!”

An additional feature allows students to click on the Sign It! icon in the upper right corner of each Web page and access a Word List of “important words” for the unit. By clicking on a letter of the alphabet displayed at the top of the Word List, students can call up the list of defined words beginning with that letter. Clicking on one of the words calls up Andy (or the character selected) to sign the word, sign its definition, or sign individual words in the definition as requested.



Andy waiting for a request to sign.

What Do Field Test Data Show?

A questionnaire for each unit that includes five questions covering its key learning goals was administered before and at the end of the field test. The questions are identical to those administered to hearing students during field-testing of versions of the units that are not Signing-

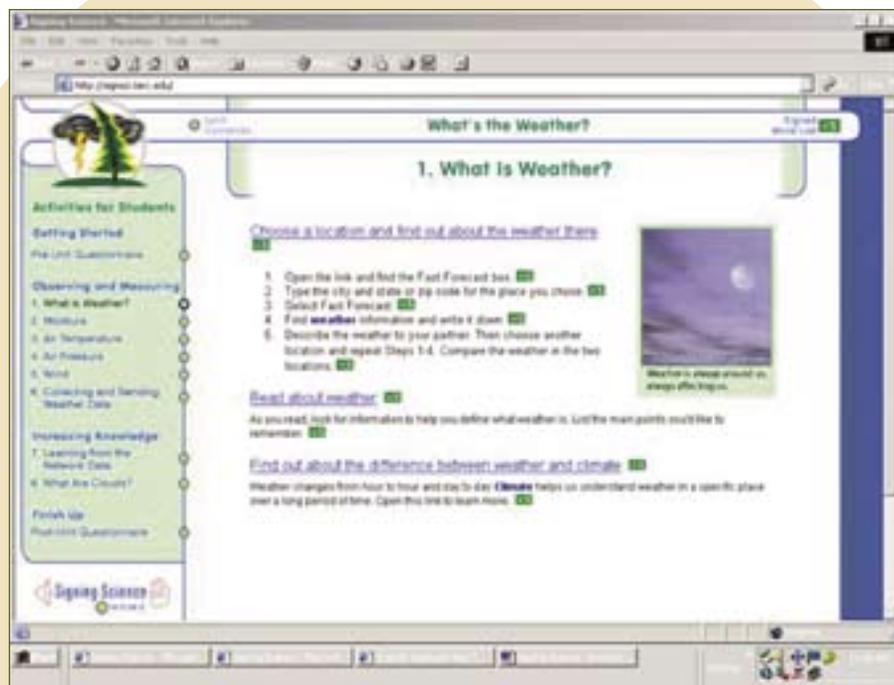
Avatar-enabled. The only difference between the questionnaires used for the units adapted for students who are deaf or hard of hearing and those for students who can hear is that they are available signed from the unit Web site.

The questions for *What's the Weather?* include:

1. Name four major things to include in a description of weather.
2. What does each of these weather instruments measure? (Choose from: air temperature, air pressure, humidity, and wind.)
 - thermometer
 - barometer
 - hygrometer
 - Beaufort scale
 - anemometer
3. Draw a picture or diagram of the water cycle. Use it to explain how clouds form.
4. Name the three basic cloud types and draw a picture of each.
5. Describe today's weather.

The questions for *Are We Getting the Oxygen We Need?* include:

1. The air we breathe contains oxygen. We need oxygen to survive. Where does this oxygen come from?
2. Take a deep breath. How does the oxygen you breathe into your lungs get to your body cells? Consider drawing a picture or diagram to show your ideas.



A SigningAvatar-enabled Web page.

3. Are the contents of the air you inhale (breathe in) the same as the contents of the air you exhale (breathe out)? Explain your answer.
4. What does the heart do? Explain how the heart does its job. Consider drawing a picture or a diagram to show your ideas.
5. List all the things that might affect your body's ability to get the oxygen it needs.

Scoring is based on a five-point system. Four represents a complete and correct response that communicates accurate scientific and technical information and correctly applies scientific concepts and processes using the vocabulary of science; three is an essentially correct response, but one that omits some detail(s) or underlying explanations or that contains inaccuracies; two is a response that is very skimpy, but correct; one is a response that is incorrect; zero indicates no answer or "I don't know." As evidenced by comparing students' pre- and postunit scores, knowledge of the material increased substantially on average from pre- to postunit assessment for students who are deaf or hard of hearing.

Scores for *What's the Weather?* went from 1.37 to 3.55. Scores for *Are We Getting the Oxygen We Need?* went from .37 to 3.62. With respect to individual questionnaire items, the group improved significantly on each of the five items associated with the unit.

What Do Teachers Report?

Teachers for both of the SigningAvatar-enabled units tested describe content-related gains associated with students' increased access to the Web-based material and their ability to work independently. One teacher writes, "Having the material signed helps my students understand it. I know they are learning the concepts because they can carry on an informed discussion in a forum set-

ting after visiting the Web site." Another teacher writes, "The addition of signing allows my students to expand their science knowledge and get really excited about the material. Because the computer is infinitely patient, they can review material as often as they need to." Still another teacher says, "Signing makes my students feel more like their hearing peers. They too can access the material on the Web. A hearing-impaired child's greatest challenge is language. With the addition of signing, access to important information that they deserve and need to know becomes more equal. The addition of signing helps level the playing field."

As an added benefit, the addition of signing appears to positively affect the ability of teachers working with students who are deaf or hard of hearing to implement the units. One teacher comments, "We can move more quickly, and I can do much more than interpret the site. It frees me up to work on clarifying questions. Plus, my students become tired of me signing to them all day and need variety. This tool is perfect." Another teacher says, "I can use the Avatar to double-check the accuracy of the signs I am using, especially the specific science signs. I double-check all the signs I am using with the Avatar. It is wonderful! If there is vocabulary I'm not sure I'm using correctly, I check with the Avatar. Too many teachers of the hearing impaired, especially for science and math, 'invent' signs or use the incorrect sign for the concept being introduced. The Avatar helps standardize the signs all of us use in the classroom."

How Do We Get Involved?

For information about participating in the field test of *What's in Our Water?* for Grades 3–6, the third EnViSci Network unit to be SigningAvatar-enabled, send e-mail to judy_vesel@terc.edu.

Resources

- Dallas Otolaryngology. (2003). *Facts and myths regarding deafness*. Available: http://cochlearimplants.dallasoto.com/facts/deaf_facts.html.
- EnViSci Network: <http://www.enviscinetwork.com/>
- National Academy of Sciences. (1996). *National science education standards*. Washington, DC: National Academy Press.
- No Child Left Behind Act of 2002*. Public Law 107–110 (January 8, 2002). Available: <http://www.ed.gov/policy/elsec/leg/esea02/>.
- SigningAvatar software: <http://www.vcom3d.com/>
- U.S. Department of Education. (2001). *Twenty-fourth annual report to Congress on the implementation of the Individuals with Disabilities Education Act*. Washington, DC: Office of Special Education Programs. Available: <http://www.ed.gov/about/reports/annual/osep/2002/appendix-a-pt1.doc>.
- What's the Weather?* and *Are We Getting the Oxygen We Need?*: <http://signsci.terc.edu/>

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or we may not have one!"
—Anita Givens, Texas Education Association