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Volume 1, Issue 1

INSIDE THIS ISSUE:

UPCOMING…

Exceptional Space & Earth Science for Exceptional Students V

July 24-28, 2005
Huntsville, AL

Planning for ENWS V is well underway, hopefully you have received an invitation (please contact Kathryn at serch@cofc.edu if you have not). **Registration is due Monday, June 6th, 2005.**

Based on attendance of TTFG members—a short TTFG meeting will be held at ENWS V.

Tactile & Technology Focus Group (TTFG)

ORGANIZERS:

DePaul Space Science Center for Education and Outreach, Origins Education Forum & Southeast Regional Clearinghouse (SERCH)

ABOUT TTFG…

Due to the increased number of persons working specifically with space & Earth science content to develop tactile graphics and technology programs for persons who are blind/visually-impaired the Special Needs Resource Group (SNRG pronounced "synergy"), along with colleagues working in this particular field, created a focus subgroup named the *Tactile and Technology Focus Group (TTFG)*. By forming this group we hope to eliminate duplication of products, enhance the creation of new products and centralize products that are and will be created. It is our belief that by coalescing this highly innovative group and the products they create the group will provide a quality resource for educators of and to persons who are blind/visually-impaired.

As a first step, TTFG will release quarterly newsletters highlighting what members of the group are doing and developing for persons who are blind/visually-impaired. **ISSUE 1, followed closely by ISSUE 2, shares with us what is being created from touching the sun, evolving the universe, reaching for the moon and dynamically generating accessible graphs.** We hope you enjoy this newsletter and find it a useful resource.

For more information on TTFG or to join contact us @:
Phone: 888-873-9475
E-mail: serch@cofc.edu

Touch the Sun: A NASA Book—What it is and what we did!

By: Noreen Grice and Ben Wentworth

Touch the Sun is a forthcoming NASA Braille book by Noreen Grice with text pages in print and Braille and 16 color thermoformed sun-related images. The project began in the Fall of 2003 when Dr. Joe Gurman and Dr. Steele Hill of the Goddard Space Science Center requested that Noreen Grice prepare an accessible tactile book focusing on the dynamic nature of the Sun and including images from SOHO and TRACE satellites.

With NASA funding and specific image suggestions from Gurman and Hill, Noreen began designing prototype tactile representations of the Sun with sunspots, interior solar layers, prominences, coronal mass ejections, magnetic field lines, ultraviolet views and space weather.

These tactile illustrations were then sent to Ben Wentworth for initial field testing with students at the Colorado School for the Blind. Ben had middle and high school students feel each graphic representation depicting solar aspects as he read the caption. Then Ben verbally described the image and asked how well the audio and tactual mind's-eye pictures coincided. The students gave their pros and cons of the tactile image and offered suggestions, if needed, to improve the clarity of the tactile representation.

Some of the items that Ben and students looked for were whether or not the textured surface was: "finger-friendly", easily detectable, was it discernable from neighboring features, was only one texture used to represent a given feature in the same illustration, did the texture convey to the mind's-eye what it was representing and was there a texture that would work better? After tallying all of the results a report of the findings was sent to Noreen with suggested changes.

Touch the Sun: A NASA Book—What it is and what we did!

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The same process was used to evaluate the revised images that Noreen sent back for review. The second review produced far less changes. During the second review process, as the students were now familiar with the images, they were asked to ensure that the written captions also clearly convey what was being described in the picture. The third review of all the images ended with an approval of everything with only a minor "tweak" here or there.

The images in *Touch the Sun* are produced using a different technique than the embossing method of pressed paper used in *Touch the Universe: A NASA Braille Book of Astronomy*. Touch Graphics Co. in New York, took Noreen's tactile designs, and with some modifications, produced an acrylic negative of each image. A master rubber mold was then made from the acrylic negative so that copies could be produced on a thermoform machine. The images are silk-screened first with the original color solar image and then thermoformed with the tactile representation.

Touch the Sun is currently in production and should be available before June 1. Copies will be distributed to schools for the blind and additional copies will be available for purchase through the Joseph Henry Press and amazon.com.

Leveling the Playing Field

By: Donna Bogner

Mid-continent Research for Education and Learning (McREL), The Colorado School for the Deaf and Blind (CSDB), and Tactile Learning Adventures have launched *The Evolving Universe*, an Adapted Curriculum Enhancement (ACE) module of exemplary science materials for visually impaired students. They are available online at http://www.ace-education.org/.

Although observing physical properties of natural objects and phenomena is critical to *scientific inquiry*, seldom do inquiry-based science curriculum materials accommodate visually impaired students. McREL and CSDB worked closely with scientists from the Jet Propulsion Laboratory and Los Alamos National Laboratory to translate the work of top NASA scientists into learning opportunities for visually impaired students and to ensure accuracy of the science content for *The Evolving Universe*.

The Evolving Universe is a series of units with lessons entitled "The Spongy Universe," "Our Dynamic Universe," and "Tracing the Origins of Pizza Ingredients." Teachers use visualization techniques, manipulatives, and tactile graphics to engage students' interest in learning more about *The Evolving Universe.*

In "The Spongy Universe," students use household sponges to explore how distance affects perspective and decide whether the precepts of the Standard Cosmological Model that describe the universe as being homogenous and isotropic are valid.

Students experience an auditory Doppler Effect in "Our Dynamic Universe" to investigate two basic precepts of the Standard Cosmological Model—the expansion of and gravitational effects on the universe today.

Combining their experiences in "Tracing the Origins of Pizza Ingredients" and their discovery of combinations of "up" and "down" quarks that form protons and neutrons, students trace the origins of fundamental particles—quarks and electrons—backwards through the early cosmic periods. When students have completed this series of activities, they will have had modeling and inference experiences relating to many of the basic precepts of the Standard Cosmological Model.

Funded through a NASA Initiative to Develop Education through Astronomy and Space Science (IDEAS) grant, these materials for teachers of visually impaired students include teacher guides, student activities, texts, and tactile materials as well as instructions for making and using them. All student materials and texts have been adapted for use by students with different levels of visual impairment.

Lessons address *National Science Education Standards* including Science as Inquiry, Physical Science, Science and Technology, History and Nature of Science, and Earth and Space Science.

Field testing for *The Evolving Universe* is still ongoing. Any science teacher interested in helping with the tests before October 1, 2005 can contact Dr. Donna Bogner at dbogner@mcrel.org.

"I Can See the Moon" © 2005 Hurd

By: David Hurd

For us in academia, the end of the semester is upon us! This means writing and grading exams, attending all the meetings that should have taken place 3 months ago, and dealing with the question, "Do you offer any extra-credit?" Of course, the last question should have been asked 2 months ago, and it's probably too late. Anyway, I wanted to take the opportunity and bring you up to speed with what we are working on in the realm of astronomy/space science materials to be produced for students with disabilities including those who are blind (by using tactiles) and people with complex communication needs (such as those who use AAC devices - Augmentative and Alternative Communication).

Before going into details, let me mention that we are definitely in a time of transition here at Edinboro University of Pennsylvania with the retirement of John Matelock. I want to take a moment and personally thank John for the years of tireless dedication to students and individuals who are blind. Without John Matelock, I would not be fraternizing with any of you in the Tactile and Technology Focus Group or any of the other venues I have had the chance to work with you! John will be missed, but he and I will continue to work together on the initiative outlined below. THANK YOU – JOHN!

Over the next year or two, we will be focusing on the moon. We will be doing this in several ways and for several different reasons. My wife has taken an increased role in advocating for the needs of AAC users. I, too, have taken an interest in producing more materials to support learning for individuals with language deficits. Many of us who were blessed to hear Scott Palmer last year in Seattle will understand the type of person we are looking to impact. It is this passion, that has driven us to couple the expertise of John Matelock (Tactile Producer) and Robin Hurd (AAC advocate and author of "Parents Corner" www.aacinstitute.org/resources/parentscorner/intro.html). In so doing we are developing a series of books on the moon (well, I guess we won't be developing them "ON" the moon (yet), but about the moon). We will be developing these books with the underlying philosophy of "universal design." In other words, we want these books to be usable by students who are blind, LD, struggle with complex communication needs and early readers in general.

The "Purpose Statement" for these books could be summed up with the bullets below…

1. Address misconceptions and misunderstandings with regard to the moon, including…
    a. why we see the moon during the day
    b. why the moon changes shape
    c. apparent size of the moon and how the size of the moon appears to change dependent on its position
    d. why we see the same side of the moon all the time from Earth
2. Address general information with regard to moon, including…
    a. morphology – craters, mares…
    b. names of the full moons and cultural connections
    c. apparent size comparisons between sun and moon and connection to eclipses.

To accomplish this, we will be writing a series of books that can be used in K-6 grade levels. The first book will validate children's observations, such as seeing the moon during the day and that it changes its shape and position in the sky. The second book will begin to explore the "whys" while the third and subsequent books will give the orbital dynamics that make it possible to understand the changing phases and position of the moon. Each book will be produced using tactile images and Braille as well as printed. Each printed copy will also have symbols to enhance the text that can be used for literacy support for struggling readers. The symbols will also support students who use alternative communication methods. (AAC)

We also will be developing some materials with our Talking Tactile Tablet. We are currently working on our circumpolar star chart and we will be developing: 1. a moon map showing landing sites (both past and future), 2. one that highlights the major visible morphological features, 3. one that highlights the interior (cross section).

"I Can See the Moon" © 2005 Hurd

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We look forward to working on this project and would really appreciate your help. Please review the "Purpose Statement" for these books/tactiles and let us know if we are missing any major components. Thank you and we look forward to seeing you sometime "down the road!"

The MDE Library and MathTrax: Accessible Software for Students

By: Robert Shelton [NASA] / Stephanie Smith [Titan Systems] / Terry Hodgson [InDyne] / Dan Dexter [Titan Systems] / Dat Truong [Boeing]

The Math Description Engine (MDE) is a library of interactive software modules that combines mathematical analysis, graphing and sonification to represent math and science information. The purpose of the MDE is to dynamically generate accessible text descriptions of graphs to make data traditionally conveyed in visual graphs available to blind and visually-impaired (BVI) users. The MDE modules use rule and computation based AI to synthesize text descriptions for graphs of mathematical equations, tables of data, and simulations. The sonification engine then renders the resulting planar curve(s) as a mixture of stereo tones.

The main library components of the MDE are the Solver, Solved Graph, Describer, Drawer and Sonify. These components work together to determine what kind of "thing" an equation is, how to appropriately describe it, and how to display it. When an equation is entered, the software puts the equation in canonical form evaluating signs, coefficients and discriminants. Through a process of algebraic reduction the equation is classified by the Solver into one of a set of identified cases or solved graphs. The Solved Graph module contains a number of cases for conic sections with specific attributes for each case. Based on the case type of the equation and the specific attributes of the equation, the appropriate feature characteristics are generated in the Describer, Drawer and Sonify modules. MDE's description, sonification and graphing components can be used independently or together. MDE's architecture supports solution synchronization among components when text, sound and graphing are used in combination.

MathTrax is an educational technology tool that demonstrates the combined capabilities of the MDE library modules. Its primary audience is middle and high school students studying algebra, pre-calculus and calculus and in particular it serves BVI math students. MathTrax fulfills a compelling educational need to demonstrate the relationship between math and real world science applications by translating and demonstrating math relationships in a tangible physical medium on a standard PC platform.

Students can create graphs by entering an equation, selecting an equation from a drop-down menu, entering raw data to be analyzed or activating a physics simulation. MathTrax graphs the equations and provides descriptions of those graphs using text and sound. The curves currently described include all first and second order equations in two variables, i.e., line, parabola, ellipse, hyperbola, circle, null set, single point, and two lines. The dynamic text descriptions and sonification make the graphs accessible to blind students who do not use pencil, paper or written graphs to study mathematics. The text descriptions can be read by Java-capable screen readers such as Jaws for Windows, or can be input to speech synthesizing software to create self-voicing applications. MathTrax provides color and line settings for traditional "drawn" graphs to aid users with differing vision-impairments.

MathTrax is currently in classroom use and was featured at the NASA/National Federation of the Blind summer science camp Rocket On! as a sounding rocket mission planning and data analysis tool. MathTrax is one of four advanced educational technology products offered by the NASA Learning Technologies incubator. MathTrax is free of charge and available online at http://prime.jsc.nasa.gov/MathTrax/.

To join the Tactile and Technology Focus Group (TTFG) please send an email with your name, organization and email to serch@cofc.edu.

"The world is full of trouble, but as long as we have people undoing trouble, we have a pretty good world."
—Helen Keller