As educators, we continue to look for approaches that excite students about science and spark their curiosity while addressing the key curriculum standards. This is with this objective in mind that LADDERS (Learning and Developing Distance Education Resources for Teachers) was created in 2005 as a joint venture between the Michigan State University (MSU) Museum and the Cranbrook Institute of Science. LADDERS provides both expert science-content and inquiry-based learning experiences using videoconference technology aimed at middle school science teachers and their students. Through LADDERS, teachers can become comfortable using videoconference technology in their classroom while helping students improve their scientific inquiry skills.

What is LADDERS? LADDERS is a platform that allows inquiry-based science teaching through various one-hour virtual field trips. These field trips expose students to the resources and expertise of museums, and other informal learning centers, that they would not have access to otherwise, and connect them to real science and real scientists. LADDERS achieves this by developing programs that offer students opportunities to make direct observations from live species or specimens that are placed in their hands. Questions and hypotheses are derived from students’ observations, and students conduct their own hands-on experiments to obtain data. Students then figure out answers to puzzles using their data and logical thinking. LADDERS thus simply provides the environment and structure that allow students to inquire about the world around them.

All LADDERS programs are taught live, using distance-learning technology, also commonly referred to as videoconference technology. Many schools in Michigan possess this technology that allows students to take “virtual field trips”. By this, we mean that the students will be able to visit scientists at Michigan State University or at Cranbrook without actually leaving their school. Concretely, the videoconferencing unit is composed of a large TV monitor, a video-camera, and some speakers, with everything linked through the internet to a similar set-up at MSU or Cranbrook. Ideally, this equipment is set up in a room where students can be seated in small groups around tables while still being able to watch the screen. At the time of the virtual trip, the presenter turns on the technology on their side (MSU/Cranbrook), and the school connects through a simple dial in (similar to calling via a phone line). As soon as the connection is made, students can see and hear the presenter on the TV monitor, and the presenter can see and hear the students on their own TV monitor, all in real time. Conversations
can then start between presenter and students, with the presenter guiding the activity, witnessing on the screen what is happening in the classroom with the students, and responding to students’ questions as the students proceed through the program. Our presenters are most often upper undergraduate students from Michigan State University, as well as graduate students in areas relevant to the program.

LADDERS was initiated in 2005 by Dr. Kris Morrissey and her colleagues following the donation of the distance-learning equipment from the Regional Educational Media Center of Michigan. Dr. Morrissey and her staff quickly realized the potential of this new technology to reach new audiences, but they wanted to stay away from one-sided presentations that do not take advantage of the interactive capabilities of videoconferencing. Thus, they created the LADDERS model with the help of the evaluation team from Randi Korn Associates. Rather than create a multitude of disparate programs, each LADDERS program has the same underlying philosophy, vocabulary, and structure. The heart of this model lies in focusing on inquiry-based science learning, with interactive hands-on activities that expose middle-school students to real science and museum expertise. LADDERS programs are designed so that educators also benefit from witnessing highly open-ended inquiry activities and techniques that they can start incorporating in their classrooms. Lastly, the LADDERS model follows the general inquiry approach recommended by the National Science Teachers Association (e.g. National Research Council 2000; Llewellyn 2007).

After an initial test period using mostly one program, we have developed several programs as well as supporting materials. With the help of Michigan middle school science teachers, we have tested our new programs and shaped them so that they address key science curriculum standards. School visits have been very helpful in getting feedback on what works and similarly on what does not work for students! We quickly realized that there are a few key components for a inquiry-based program to be successful: first, we needed students to be excited about what they were observing, such as live critters; second, we needed students to be presented with exciting and puzzling questions to solve; and lastly, we needed to let students decide on the direction their inquiries took them. These foundations are now integrated into all of our programs.

Since 2005, the Michigan State University Museum has created four programs that follow this general model. Our very first LADDERS program, called “Jiminy Cricket”, teaches scientific inquiry by letting students observe crickets. In this program, students observe live crickets in their classroom and discover what happens when male crickets are placed with other male and/or female crickets. Students learn through this activity to observe animal behavior, and to derive hypotheses from their observations that they can then test through observations. One of the strengths of this program is that it breaks the misconception that “all scientific investigations […] employ controlled experiments” (Forbes 2007): students can see the power of observational data, which are employed very frequently in scientific fields such as behavioral ecology (Alcock 2001). Following this program, we developed “Termite Behavior: Running in Circles”, a program in which students build on this knowledge of the scientific method by exploring concepts of experimental design. In this program, students observe the behavior of live termites, and solve a puzzle by designing and running small controlled experiments. Both programs are grounded on inquiry-based learning, while stimulating students about science and nature. However, they both remain light in actual content, and thus provide wonderful opportunities for educators to build on lessons using insects, be it about social behavior, animal communication, or even social studies, such as the positive and negative effects of termites in the United States.

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More recently, we have developed our third LADDERS program, “Galapagos Finches: Evolution in a Nutshell,” that addresses evolutionary biology directly. This program was created from the expressed need of educators to introduce the topic of evolution to the classroom using a program developed by scientists themselves. For educators, evolution can be an intimidating subject to teach because of the anti-evolution education movement we have witnessed in the United States over the last few years. However, it is crucial that students gain an understanding of evolution, as this theory is at the core of science itself (e.g. NSTA 2003; Forbes 2006). This program provides educators with an opportunity to introduce evolution in their classroom by letting students replicate the findings of Rosemary and Peter Grant in the Galapagos islands on the famous Darwin finches (summarized in Grant & Grant 2003; see Weiner 1994 for a wonderful summary of the Grants’ research aimed at a general audience). The program allows students to experience first-hand how specific changes in the environment can lead to changes on bird beak sizes in a very short time span. In addition to introducing evolutionary biology concepts to the students, we provide educators with a thorough and in-depth package that includes the key concepts of evolution explained with concrete examples, vocabulary, and resources to help them refine their understanding of evolution.

Our fourth and newest program, called “Invisible Universe”, will be offered in late Spring of 2008. In this astronomy program, students will see how astronomers use all kinds of lights, from radio to X-ray, to learn about the universe. Designed specifically to cover the new astronomy benchmark, this exciting program provides expertise less commonly available, and links students directly with science carried out at Michigan State University.

DO YOU WANT TO PARTICIPATE IN A LADDERS PROGRAM? UNTIL THE END OF THE SPRING SEMESTER, IT IS FREE AND YOU ARE ONLY 3 STEPS AWAY!

1. Check that your school has access to videoconference technology
2. Choose which of our programs is most appropriate for the grade that you teach and the planning of your lessons (see our website for grade levels recommended for a given program)
3. Contact us via email or phone for availability, and book a program

LITERATURE CITED:

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