For the birds: University City educator uses bird watching as a bridge to math and science

Step into Nikki Davenport's office at the University City School District, and you may think you have walked into an aviary.

Models, photos, and drawings of birds create a symphony of color. Blink, and it seems as if the birds are flying around, searching for the nearest branch, feeder, or cabinet to land on. In the middle of it all, a cheerfully smiling woman with wide brown eyes describes each of the images. The drawings are detailed, colorful, anatomically accurate, and correctly identified.

Startlingly, most of the artists are students in grades 3-5.

Davenport's official role is math and science coordinator for the district. But she's better known as the "Bird Lady." As a teacher at Jackson Park Elementary, she formed a birding club. As science coordinator, she's encouraging teachers to observe and report on birds with their classes. It's not just for fun, explains Davenport. A sound educational research base reveals the method behind Davenport's bird mania.

"When I became coordinator, the first thing I wanted was to get Bird Sleuth to other teachers because it's so inquiry based," she says. "It's very cross-curricular. You can do it all year. There's a literary aspect with poetry, books, and even history. And the math tie is very intense with data gathering, interpreting, then to graphing and online entry."

The Bird Sleuth curriculum from Cornell University encourages students to study birds and their local habitats. Then kids enter their observations online. Researchers from Cornell use them to study migration patterns across North America. As part of University City's ongoing partnership with Washington University, the National Science Foundation supported a teacher workshop on Bird Sleuthing in January.

Look, over there! University City teachers field tested birding curriculum from Cornell University through a district workshop organized by math and science coordinator Nikki Davenport. Educators Kathleen Evans, left, and Jan Oberkramer, right, of the Green Center joined in the observations.

Kim Diallo, fourth-grade teacher at Pershing Elementary, attended the birding workshop. "I found myself getting enthralled in bird watching," says Diallo. "I now have lots of ideas about introducing birds to my kids as a way to get them motivated in the classroom."

Davenport's journey is as remarkable as the wood thrush's annual migration. As a child in Colorado, she loved school and wanted to be a teacher. But she wasn't able to attend college as a full-time student. So she worked, had a family and attended evening classes in California and then in St. Louis.

Davenport began her first full-time teaching assignment at Jackson Park Elementary School in 2002. By summer 2003, she was already back in school. She began

"Mile wide and inch deep" no more: Educators streamline Missouri K-12 math curriculum

Following a call to action by business and education leaders in April 2006, a team of Missouri mathematics educators has developed a new set of K-12 math learning goals to replace the current Grade Level Expectations (GLEs). Victoria May, assistant dean of Arts & Sciences and director of Science Outreach, is a member of the Missouri Math, Engineering, Technology and Science Coalition, which is advocating for rigorous educational standards.

"We're interested in ensuring Missouri's economic future," says May. "The business leaders who are in the METS coalition realize that education plays a major role in preparing the scientific and technical workforce."

As a leader for the METS strategy to improve P-20 student performance, May knew that having a strong set of learning goals tied to assessment guidelines was essential. The current Missouri GLEs are often accused of having the same problem as most of the U.S. math curriculum: "a mile wide and an inch deep." The problem, explains Barbara Reys, professor of mathematics education at University of Missouri-Columbia, is not with the GLEs, but with the way they are being used.

"You can't test everything a student is supposed to learn in a year," says Reys. "But No Child Left Behind wants data for every year. So the GLE document was developed so teachers know what's fair game for assessment in a given year. It was never meant to be a full curriculum but rather a guide for assessment. However, teachers have used it as a curriculum guide. What's needed is more and clearer guidance regarding core concepts."

Those core concepts, explains Reys, are key to understanding math. "Math is a hierarchical subject. What students learn one year is the foundation for more advanced learning the next," she says.

To address this gap, May and Stan Johnson, assistant commissioner for the Missouri Department of Elementary and Secondary Education (DESE), organized a team of leading educators to create a set of curriculum goals for the state. Writers included educators from 14 districts and university math education faculty.

In addition to personal experience, Reys says the writers drew on recommendations from the National Council of Teachers of Mathematics, the College Board, and Achieve. These institutions advocate organizing curriculum around a few core concepts. Cindy Bryant, mathematics consultant for Missouri

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Engineering outreach program opens career paths for young students and graduate fellows

Ask most sixth-graders what engineers do, and you will hear: “They drive trains.” At Washington University’s School of Engineering, a dedicated group of faculty and graduate students are working to change this perception. In addition to their course work and research, graduate students spend approximately 10 hours each week in local classrooms, helping young students learn what engineering is all about. The program is part of an effort by the National Science Foundation to help scientists in training improve their communication skills and teaching abilities. Called the Graduate Teaching Fellows in K–12 Education (GK–12), all science, mathematics, technology, and engineering graduate programs across the country are eligible to participate. And not only the graduate students benefit. NSF requires that the program be enriching for K–12 students as well.

Science teacher Don Knobbe from Steger Sixth Grade Center in Webster Groves says he has welcomed graduate teaching fellows into his classroom for the past five years. The experience is one of his students’ favorites each year, says Knobbe, and it also enriches his teaching. “I’ve worked with the fellows to develop modules that support our curriculum,” Knobbe explains. “So we’ve taken things like force and motion, so we are able to easily work on mechanical engineering, and forces involved with machines. With the structural engineers, we work on earthquake resistant structures, which fits in with our earth science unit.”

Kevin Truman, professor of mechanical, aerospace, and structural engineering, is the principal investigator for the GK–12 project. He admits that such a strong time commitment to schools can slow research progress for faculty who need the graduate fellows’ time in the lab. But, he adds that the benefits make the tradeoff worthwhile. “The GK–12 program allows us to be competitive in the market for top graduate students,” says Truman. “And the fellows gain confidence, communication skills, and improve their ability to plan and focus. It helps them think like an engineer, having to plan for the beginning, middle, and end of a project. It actually helps them be better prepared to do their research.”

Making the jump from graduate program to high school or middle school classroom can be a challenge for the fellows. To ease the transition, Phyllis Balcerzak, director of professional development for Science Outreach, leads a seminar for the GK–12 fellows. “It’s a real shock for the fellows,” says Truman. “They go in with expectations that the kids know more. Phyllis does a great job of preparing them for the classroom, explaining how to teach, saying ‘don’t lecture,’ and describing where kids are developmentally.”

Adam Nathan, BSME ’06, MSME ’08, has completed two years of classroom teaching with Knobbe at Steger. He says the experience has been extremely rewarding. “I was surprised most by the level of creativity and openness to learn and solve new problems,” says Nathan about the students at Steger. And he echoes Truman’s focus on communication skills. “The ability to translate technical information to something geared toward the general population is so important,” explains Nathan. “Lots of engineers miss out on the ability to explain what they do.”

The GK–12 program will continue its win–win approach for graduate students and schools into the next four years. It has recently entered its second five-year period of NSF support. And Nathan is headed for his next challenge: a position with General Electric’s healthcare division in Milwaukee. He says that the opportunity to work in schools through a GE outreach program was one of the reasons he accepted the job.

Hydrogen powered cars race the halls at Metro High School

No, they’re not terribly fast—about the speed of a slow walk. But these hydrogen powered model cars help students get ahead in understanding how biology, chemistry, and environmental science are linked.

Students in Kerry Zimmerman’s class at St. Louis Public’s Metro High School are studying alternative fuels and learning about sustainable energy and global warming. This is science that kids, parents, and teachers can relate to—especially as the cost of filling the gas tank continues to climb.

Last summer, Zimmerman participated in a workshop at Washington University that introduced teachers to hydrogen and microbial fuel cells, biodiesel, and simulations of global warming that can be created in a classroom setting. Now, she and her colleagues across St. Louis are doing these investigations with their students.

“This hydrogen fuel lab is a great bridge between old and new topics in biochemistry and chemistry,” says Zimmerman.

Philip Weyman, postdoctoral researcher in biofuels at University of Missouri-St. Louis, taught the July 2007 workshop. As he investigates how bacteria produce hydrogen, Weyman also works with teachers to bring alternative energy to the high school science lab.

“Renewable fuels are terrific teaching tools that tie into and enhance traditional chemistry,” says Weyman.

Grants from the National Science Foundation and the Howard Hughes Medical Institute support the biofuels lending program for teachers.
The Kirk family establishes an endowment for middle school science education

David L. Kirk, professor emeritus of biology, and his wife, Marilyn, have established the David and Marilyn Kirk Science Outreach Endowment. The Kirks did research and taught for more than 30 years in the department of biology. Professor Kirk also contributed his expertise to the development of curriculum and other outreach programs. Their gift will support programs for Missouri teachers, with a focus on middle school science courses and fellowships.

“The Kirks have been wonderful leaders and consultants for our programs over the years,” says Victoria L. May, outreach director and assistant dean of Arts & Sciences. “This generous gift will help teachers who don’t have the resources to be involved in Washington University science education programs. I am extremely grateful for David and Marilyn’s thoughtfulness and generosity,” she says.

The Kirk lab has conducted research in biology at Washington University since 1969, with a focus on the single-celled organism Volvox carteri. At a 2007 symposium, the Kirks were honored for their groundbreaking research contributions. And now there is a volvox species that reflects their years of dedication. Hisayoshi Nozaki, professor of biological sciences at the University of Tokyo, has named a species of Volvox in the Kirks’ honor: Volvox kirkiorum.

Modern Genetics for All Students celebrates 15 years in the biology lab

Studying genetics is essential to understanding biology. But helping students understand the critical role of DNA can be tough. After all, it’s a molecule, visible only with the most powerful microscopes.

When Sarah C.R. Elgin, professor of biology, noticed that the biology curriculum her sons were studying in University City didn’t include hands-on work to explore DNA, she knew she could help. She approached the biology teachers, and got them involved as writers and advisors on a lab intensive curriculum on recent developments in genetics. Then they piloted the investigations, starting in fall 1992.

Fast forward 15 years: 23 teachers in 10 high schools in the St. Louis area are using Modern Genetics in 2007-08. Since 1992, more than 41,000 St. Louis area students have experienced its hands-on investigations. Plus, an estimated 50 teachers from across the United States use Modern Genetics. And teachers in 31 countries outside the United States, including Pakistan, Ireland, Morocco, the Philippines, and Sweden, have downloaded copies of the 500-page curriculum.

Keys to Modern Genetics’ success and longevity include a system of teacher professional development and support, and its use of real organisms like yeast and bacteria. And the program’s effectiveness has been documented in professional journals and in evaluation studies.

Pre/post testing from the program’s early years shows that boys and girls of all abilities and backgrounds make knowledge gains as a result of using Modern Genetics. A more recent study compared students who used Modern Genetics with those who learned genetics using a standard textbook. It showed that while both groups learned the same amount of material, the students using Modern Genetics made greater gains in understanding. They also made much higher gains in critical thinking skills. According to Elgin, this is also by design.

“As genetic discoveries continue advancing, people are going to face more complicated decisions about their health,” says Elgin. “In Modern Genetics, we have students testing ‘samples’ for genetic diseases and learning about inheritance patterns.”

Webster Groves High School biology teacher Regina Lynch was one of the original pilot testers for Modern Genetics. She attributes the program to getting her students excited about genetics, and also keeping her motivated as a teacher.

“The kids still love it. It’s amazing, it perks up the semester for them,” she says. “And the beauty of it is, [Washington University] brings the stuff!” explains Lynch.

For partner districts, the prepared Modern Genetics materials are available at cost. Lynch says this makes it possible for her to stay within her supplies budget. “If teachers have four or five dollars per student per year for disposable materials, this makes it affordable.”

Teachers can also order materials from educational suppliers, or prepare their own. Instructions in the Modern Genetics teacher’s unit provide guidelines and sourcing information.

Modern Genetics has grown over the last 15 years. Now it includes two additional units for advanced students, one on genomics and another on agricultural biotechnology. Support from the National Institutes of Health, the Howard Hughes Medical Institute, and the Monsanto Fund have contributed to development and dissemination of the program.

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2008 COURSES & PROGRAMS

Summer
• Exxon/Mobil Bernard Harris Summer Science Camp for middle school students, June 15-27
• Environmental Biology Field Research Experiences for high school juniors, June 9-27
• Life Sciences for a Global Community, teacher cohorts 1 and 2 in residence, July 6-August 1

Fall
• Lenses on Learning, a focus on math and school leadership for K-8 principals
• Math Coaching in the K-8 Classroom
• Edu 6012 Hands-On Science K-8: Earth and Planetary Sciences
• Edu 7000 Teaching Physical Science: Inquiry methods for 9-12 teachers

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Keeping it real: Schnikia Pool, freshman biology student at Webster Groves High School, extracts DNA from pureed strawberries in a lab investigation from Modern Genetics for All Students.
an ecology education internship at Washington University's Center for Inquiry in Science Teaching and Learning. She worked at Tyson Research Center, writing science curriculum, teaching field classes, and researching teaching methods. She continued focusing on ecology in her studies, then became a pilot teacher and writer for the Bird Sleuth curriculum.

Marty Galganski, former director of the Tyson field science program for K-12 and instructor in education, was her internship supervisor. "When the term ‘reflective practitioner’ was coined, Nikki was the model,” says Galganski. “She effectively blends researched instruction and content knowledge with a creative energy that stimulates children to learn more.”

Davenport's former principal at Jackson Park, Carlos Diaz Granados, confirms that Davenport is an energetic teacher. “Nikki is a phenomenal, tireless educator” he says. Since moving to the coordinator position, Davenport works with teachers to make recommendations about curriculum materials, adapting them, or adopting new ones. She’s also leading writing teams for math and science curriculum. Davenport says that a collective process is essential to developing a cohesive district program. “We have to do it as a group,” says Davenport. “I need everyone's input.”

Davenport also advocates for more time in the school day for science. She knows it’s a challenge for teachers to do the time-intensive prep needed for successful science lessons. So she sees her job as providing support. Davenport’s persistence is beginning to pay off. She says now that teachers are getting involved in birding, more students are experiencing the excitement and benefits of participating in the Bird Sleuth program.

Meanwhile, Davenport continues her own educational journey. In May she will again cross a stage to receive a diploma: her master of arts in education from Washington University, with an emphasis in science.

Of note

The Boeing Company has made a gift of $50,000 to support mathematics programs for K-12 teachers and administrators in 2008-09. The major components of this program include professional development for principals through Lenses on Learning, a training program for math coaches, and the spring 2008 Edu 6010 Mathematics Concepts course for K-8 teachers.

ExxonMobil/The Harris Foundation has donated $80,000 to support the ExxonMobil Bernard Harris Summer Science Camp for middle school students for a second year at Washington University. Harris, a space shuttle astronaut and flight surgeon, started the camps as a way to inspire young children to pursue their dreams. Washington University is one of 23 institutions in the country hosting a camp this year.

Mastercard Worldwide, based in O’Fallon, Mo., has given $35,000 in support of meetings for school administrators on the revised Missouri K-12 mathematics learning goals. The meetings will be co-sponsored by the Missouri Department of Elementary and Secondary Education and the Regional Professional Development Centers. They will provide school leaders with the information they need to plan curriculum and teacher professional development. See related story, page 1.

The Monsanto Fund has donated $3 million to continue its support of MySci hands-on science for elementary students through 2011. The mobile program features the Investigation Station and classroom activities in plant and animal science for grades K-2.

Educators

DESE says that the new goals provide benchmarks for critical learning as recommended in the National Math Panel report.

“The core concepts provide the broad focus for each grade or course,” explains Bryant. “There are three to five core concepts with measurable learning goals under each one. Then there are performance indicators, which are equivalent to the current course and grade-level expectations.”

“The bottom line goal is to provide more specific direction on how to organize and deliver instruction to prepare students for higher level math,” says Reys.

The highly specific and organized goals in the new document help schools develop an effective learning progression through the grades, without duplicating what was taught previously, or skipping a key concept. This specificity isn’t available in commercial textbooks, says Reys.

“New current texts align perfectly to any state standards because there are 50 states and 50 different sets of standards,” she says. “However, Missouri is on the leading edge of a national movement toward standards organized around a few core concepts at each grade.”

Whether old or new, textbooks are important to consider when planning school curriculum. Audrey Jackson, program coordinator in leadership development for St. Louis Public Schools, says that when tax bases are depleted, curriculum and instruction suffer. “If a district has old textbooks because it can’t afford to replace them, these revised goals will assist in helping districts determine what needs to be supplemented,” she explains.

The draft document, titled “Missouri K-12 Mathematics Learning Goals,” will be posted on the DESE website this spring. Educators and the public can offer feedback through a comment form on the site. Then during the summer, the writing team will revise the draft goals, before the final draft is submitted to the Missouri State Board of Education in September.

Schools will have a transition period before the new math goals are reflected on the Missouri Assessment Program tests in 2010 or 2011.