Children are natural performers, and they love using their imaginations, so Readers Theater makes reading practice an adventure instead of a chore.

Bringing Science to Life — pg 80

FEATURES

12 School Librarians, Science Teachers, and Optimal Learning Environments
Barbara Schultz-Jones

20 Speak Up!
Students Embrace Digital Resources for Learning
Laurie Smith & Julie Evans

28 Teachers’ Domain:
Digital Media (Including Video!) Resources for the STEM Classroom and Collection
Daniella Quinones

34 Beyond Penguins and Polar Bears:
Bringing the Polar Regions Closer to Home
Jessica Fries-Gaither

40 Cook Up Curriculum with Content Clips
Lois McLean

48 Using Social Media to Build an Online Professional Learning Network of Middle Level Educators
Kim Lightle

54 NSDL as a Teacher Empower Point
Expanding Capacity for Classroom Integration of Digital Resources
Eileen McIlvain
“Science teachers try to find a range of resources—visual, auditory, and interactive—to use in their instructional planning and teaching; however, many are stymied by where to start to find science materials and what alternatives to generic search engines are available.”

Making Science Learning Available and Accessible to All Learners — pg 64
My husband Harry, now retired, was a science teacher for thirty-three years in the same classroom. He was hired to teach high school physics without having a certificate in that area—very often the case, both back then and today. In a few years, though, a position opened up in the middle school in his specialty: earth and space science. He jokes that they built a new high school and left him behind. He likes to joke about a lot of things, one of them being my degrees in library “science” because he never understood the science part. I’d try to explain that it was a social science and that the field has a body of research, uses empirical methods, and studies information and its relationships to individuals and society. I’m not sure I’ve convinced him yet.

I’m also not sure if I ever convinced him of how collaboration with his school librarian might have enriched his curriculum. He worked with good school librarians, respected them, and his school library’s collection was above average even though the building it was housed in was built in the 1920s. But Harry was always very happy to rely on his own collection of classroom materials, which were safely locked away in the closet or on his computer. I’d often share things I was doing with my science teachers, and later when I became a professor, lessons my graduate students had created that integrated science. He thought they sounded interesting and worth doing. If his school librarian had initiated the collaboration, I think it would have taken off and blossomed.

Harry’s behavior is fairly typical, according to Dr. Marcia Mardis, the guest editor of this issue of Knowledge Quest. Marcia researches the relationship of science education, science resources, science teachers, and school librarians—and is our profession’s expert on the topic. She has found that most science teachers, more than educators in other subject areas, experience an ownership of their subject, curriculum, and classroom resources (Mardis 2004, 2007). Simply stated, they are hard nuts to crack when it comes to collaboration. But there’s a flip side: school librarians are uncomfortable with science, and it’s a consequence of where we come from. Few school librarians have been science teachers or have a degree in the hard sciences (Mardis 2007). Less than 5 percent of our professional reading contains information about science resources, activities, or collaborations (Mardis 2006). Is it any wonder, then, that this conversation is hard to start? It’s easier to talk the same language with an English or social studies teacher if that’s your own background.

Information inquiry, which is an extension and expansion of information literacy, is strong common ground that can bring science teachers and school librarians together.

Is it any wonder that this conversation is hard to start? It’s easier to talk the same language with an English or social studies teacher if that’s your own background.
Information inquiry, which is an extension and expansion of information literacy, is strong common ground that can bring science teachers and school librarians together. Students performing information or science inquiry use similar skills—hands-on learning, collecting and evaluating evidence, working in collaborative groups, drawing conclusions, and presenting results. Science teachers and school librarians also carry out similar roles in inquiry. They work as guides, coaches, and facilitators, evaluating both process and product. Equally, they use models to frame the experience—the scientific method for science teachers and the information search process for school librarians. The learning environment of a science lab and a school library are similar. (See “School Librarians, Science Teachers, and Optimal Learning Environments” by Barbara Schultz-Jones in this issue.) Co-planning, co-teaching, and co-assessing with science teachers can be one of the most enriching of all experiences because of these shared values.

The Common Core State Standards <www.corestandards.org> provide an opportunity to reexamine how we facilitate cross-disciplinary learning. We can use the standards to initiate conversations with science teachers, curriculum specialists, and administrators. But to take this one step further, I have appointed an AASL Crosswalk Task Force that is charged to:

- examine the Common Core State Standards for English Language Arts,
- examine AASL’s Standards for the 21st-Century Learner,
- determine the areas of compatibility, and
- develop a crosswalk document that compares the two sets of standards and highlights the areas where the two sets of standards meet.

But if you need another method to initiate conversations with your science teachers, use the word “free.” For this theme issue and in celebration of the tenth anniversary of the National Science Digital Library, Marcia Mardis has assembled an outstanding bevy of authors whose backgrounds and expertise lie in working with digital science collections. They provide concrete suggestions on how to use quality free images and video clips, incorporate electronic whiteboards, and more to enhance science teaching and learning.

Start the conversation!

AASL President Nancy Everhart is an associate professor at the Florida State University College of Information where she directs the school library media program, Project LEAD, and the PALM (Partnerships Advancing Library Media) Center.

Works Cited:


Rock Concert Style T-Shirt Sales Will Support the Vision Tour!

You will love wearing this T-shirt in support of outstanding school libraries. On the front is a silhouette of two children - one holding a book and one holding a computer. On the back is a list of the outstanding school libraries on the Vision Tour. These black Ts are 100% pre-shrunk cotton, available in adult and children’s sizes. Cost is $18 each, and a large percentage of this funding supports the Vision Tour. I’d love to see you wearing a shirt at the ALA conferences! Go to the website www.outstandingschoollibraries.org and click on the link to the online store.
I t all seemed relatively straightforward. In the world in which many of us grew up, content was scarce and access often difficult, if sometimes exotic. Who, in Kaye’s beloved field of comparative literature, did not dream of a summer at the Folger Shakespeare Library or the Bibliothèque Nationale, pouring through manuscripts, for which part of the allure was that they were hard to find and even harder to access? Those of us who became school librarians in an age when print dominated find ourselves confronting new ideas about what we should collect, how we should ensure access, and who we can be in our schools.

And so we celebrate nearly a decade since Knowledge Quest focused exclusively on science for our students (volume 31, no. 3, January/February 2003). That issue heralded the opening of the National Science Digital Library (NSDL) and showcased some of its most exciting collections and services for science, technology, education, and mathematics (STEM) teaching and learning. WGBH’s Teachers’ Domain <www.teachersdomain.org>, an incredible free collection of high-quality multimedia from its PBS-broadcasted programs and implementation scaffolds that rival Discovery Education’s Streaming service, was part of that issue and is still going strong, with expanded offerings and an ever-growing user base. Be sure to check out Daniella Quinones’s article on Teachers’ Domain in this issue for more information about how you can make use of this exciting collection.

When NSDL started, now a decade ago, a vastly expanded access to digital content seemed, almost in and of itself, transformational. One of the foundational and iconic documents of NSDL, Pathways to Progress: Vision and Plans for Developing the NSDL, written in March of 2001, opened with this statement:

“The National Science, Mathematics, Engineering, and Technology Education Digital Library was conceived and is being constructed to support excellence in SMET [now STEM] education for all Americans. The NSDL will be a comprehensive information system built as a distributed network and will develop and make accessible collections of high quality resources for instruction at all levels and in all educational settings” (NSDL 2001, 1).

Even at that early moment, our colleagues realized that more than good content was needed. The digital world gave us access to another valuable resource—connection. They went on to say:

“...will also establish and maintain communications networks to facilitate interactions and collaborations among all [STEM] educators and learners, and will foster development of new communities of learners in [STEM] education” (NSDL 2001, 1).
This was, and remains, a compelling vision. In so many ways, education is the nation’s civil religion, and the Internet gave us the means to expand and enhance the community of educators and learners, to share scientific knowledge, to link the world of research to the world of the classroom, and to increase the speed of knowledge dissemination. Resources like Beyond Penguins and Polar Bears <http://beyondpenguins.nsdl.org> bring users scientific information in accessible ways that allow every user to understand the crucial nature of pressing concerns like environmental stewardship. Tools like Content Clips <www.contentclips.com> allow learners to combine media to express those understandings in new ways. These exemplary and related projects are featured in articles in this issue. (See Lois McLean’s and Jessica Fries-Gaither’s articles for more about Beyond Penguins and Polar Bears and about Content Clips).

The Middle School Portal Math Science Pathway (MSP2) <http://msteacher2.org>, also featured in this issue (see Kimberly Lightle’s article), has embraced this idea of cultivating community with cutting-edge tools and services that allow educators to connect with one another to bring STEM teaching and learning to active, vibrant life. Day and night, the MSP2 site hums with discussions, recommendations, and support for literature lovers, weekend biologists, and educators striving to create excellent STEM education experiences for all learners.

We are still in the middle of cultivating a strong community, working to bring the vision to quotidian reality. In another article in this issue, Eileen McIlvain, an integral member of the NSDL leadership team, does a wonderful job of laying out the current reality of NSDL and how close we are to achieving community among and connection to STEM learners. We are closer than when we started but not as close as we would all urgently wish to be, and we are painfully aware of all that must be done.

The most significant aspect of that challenge is expressed in the most important of our lessons learned: Start where users are, understand that, and stay responsive to changing needs and realities.

The researchers from Project Tomorrow <www.tomorrow.org>, featured in Julie Evans and Laurie Smith’s article in this issue, bring us the evolving reality every year with their Speak Up survey results. Since Project Tomorrow began in 2003, more than a million and a half students, teachers, administrators, parents, and, recently, pre-service teachers respond each year to the survey about the use of technology in the classroom. Results are released every year in Washington, DC, and in 2010 Project Tomorrow CEO Julie Evans laid out the #1 trend seen in 2009 Speak Up data—the Free Agent Learner (Project Tomorrow). Here’s the profile of that learner:

<table>
<thead>
<tr>
<th>Self-directed</th>
<th>Not tethered to physical networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untethered to traditional education</td>
<td>Values experiential learning—make it real and relevant</td>
</tr>
<tr>
<td>Expert at personal data aggregation</td>
<td>Content developer</td>
</tr>
<tr>
<td>Knows the power of connections</td>
<td>Considers process as important as knowledge</td>
</tr>
<tr>
<td>Creates new communities</td>
<td></td>
</tr>
</tbody>
</table>

In many ways, that Free Agent Learner is every teacher’s dream. Nevertheless, that learner is challenging and disruptive of the order and authority of the classroom that has been comfortable to us, however much we ourselves may have complained about its limitations. More and more of these learners, we assume, must find the traditional classroom more constraining and even less relevant every year.

Not that we don’t articulate an understanding of disjunction ourselves. Dave Yaron, a long-time NSDL community member and professor of chemistry at Carnegie Mellon, wrote:

“Many of these challenges [facing NSDL] arise from juxtaposing the formal education system, which is shockingly resistant to change, with the Internet, which is shockingly able to undergo radical transformations on a moment’s notice. Life at the interface of these differently paced worlds can instill a professional version of manic depression. Ideas intended to radically improve education most often end up having incremental impacts” (Yaron 2009).

These strong ideas, echoed in the article in this issue by Julie Evans and Laurie Smith, are explored by the research reported by Barbara Schultz-Jones, in which her study of school libraries as flexible learning environments highlights the multifunctional nature of our workspace and the agility we must have to support the many different ways learning occurs within it.
We MUST not be content with the incremental. To move beyond it, we must understand the user. NSDL has all sorts of users, but, arguably, the most significant for educational impact look very much like that of Project Tomorrow’s Free Agent Learner.

To help us Mizuko Ito and her team created the book, *Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning with New Media*, part of the John D. and Catherine T. MacArthur Foundation Series in Digital Media and Learning (2010). Until you have a chance to read it yourself, here are some of the book’s illuminating observations, based on watching kids and their communities:

"Educators and policy makers need to understand that participation in the digital age means more than being able to access “serious” online information and culture; it also means the ability to participate in social and recreational activities online. This requires a cultural shift and a certain openness to experimentation and social exploration that generally is not characteristic of educational institutions (347)….On the interest-driven side of the equation, the ways in which we have sheltered youth from workplaces and institutionalized them in age-segregated schools means that there are few opportunities for youth to see adults as peers….When kids have the opportunity to gain access to accomplished elders in areas where they are interested in developing expertise, an accessible and immediate aspirational trajectory…can be created” (350).

And, as they move from vision to dream:

"Kids’ participation in networked publics suggests new ways to think about the role of public education. Rather than thinking of public education as a burden that schools must shoulder on their own, what would it mean to think of public education as a responsibility of a more distributed network of people and institutions? And rather than assuming that education is primarily about preparing kids for jobs and careers, what would it mean to think of education as a process of guiding kids’ participation in public life more generally, a public life that includes social, recreational, and civic engagement? And finally, what would it mean to enlist help in this endeavor from an engaged and diverse set of publics that are broader than what we think of as educational and civic institutions?” (352–53).

We all understand the investment we have in formal education and its institutions, and we all honor those who labor there day after day. Given the ubiquity, agility, and flexibility of the Internet, given the deep commitment of communities like the NSDL’s developers and users, and given the desire we all share to understand the whole range of education, we should take these observations to heart and apply them, as best we can, in our well-known contexts—including the school library.

We have, in NSDL and with projects like those described in this issue’s articles, powerful resources for educational impact—if we can genuinely interact with that youthful user. Can we become, as *Hanging Out* describes (349), “co-conspirators” in their education? As Anne Marie Perrault suggests in her article in this issue, can we use resources like the NSDL to ensure that we reach all of our students in the school library? How can we be vehicles for inclusion?

We have much demanding work to do in school libraries to support STEM learning. With its content, through its technologies, and using its network of trusted partners, NSDL can further understanding of the vexing and demanding role of STEM in student learning. School librarians can be vital links between digital resources and school-based users, as Laura Stroup, Gigi Lincoln, and Mary deWolf testify. These three school librarians used their library science backgrounds and commitment to learning in an early NSDL participant, Michigan Teacher Network (MTN). Now called Michigan Online Resources for Educators (MORE), for a decade this digital library has built on the expertise of school librarians to offer thousands of free high-quality education resources linked to Michigan’s Grade Level Content Expectations. Marcia Mardis, guest editor of this issue, directed MTN from 1998–2008.

Marcia Mardis is an assistant professor at the School of Library and Information Studies at the Florida State University, where she codirects the Partnerships Advancing Library Media (PALM) Center with AASL President Nancy Everhart. Marcia is also the chair of the NSDL National Accessioning Board and researches digital libraries, school libraries, and science learning.
About This Issue
The aforementioned articles above are presented in this issue in three sections:

• The Research, which reports current research relating to STEM and school libraries, includes contributions from University of North Texas professor Barbara Schultz-Jones, and Project Tomorrow leaders Julie Evans and Laurie Smith.

• The Collection, which includes profiles of exemplary resources of interest to school librarians, features NSDL projects MSP2, Teachers’ Domain, Beyond Penguins and Polar Bears, and Content Clips.

• The Implementation Strategies provides concrete ways in which to use the NSDL and other STEM resources in the school library to foster student learning.

Nearly a decade after the last Knowledge Quest issue that focused on science, it is clear to school librarians, as well as to STEM teachers and learners, that we are in a genuinely new place, and we need to understand and participate as co-conspirators in creating that new geography for children.

In the Bible, Joel 2:28 tells us
"...your old men shall dream dreams,
your young men shall see visions."

Kaye Howe is the National Science Digital Library’s (NSDL) Core Integration director. She also leads the Resource Center for the National STEM (Science, Technology, Engineering and Mathematics) Digital Library.

Works Cited:
School Librarians, Science Teachers, + Optimal Learning Environments

“School libraries are essential to the development of learning skills. School libraries provide equitable physical and intellectual access to the resources and tools required for learning in a warm, stimulating, and safe environment. School librarians collaborate with others to provide instruction, learning strategies, and practice in using the essential learning skills needed in the 21st century.”

Standards for the 21st-Century Learner (AASL 2007, 3)
The terms “learning” and “environment” are a natural part of our school library lexicon. We frequently refer to the library’s “learning environment” and include this reference to describe the setting for a wide array of vibrant programs and collaborative efforts. According to The 2009 Horizon Report: K–12 Edition, one of the top five key trends affecting the practice of teaching, learning, and creative expression in K–12 schools is our consideration of learning environments:

“The way we think of learning environments is changing. Traditionally, a learning environment has been a physical space, but the idea of what constitutes a learning environment is changing. The ‘spaces’ where students learn are becoming more community-driven, interdisciplinary, and supported by technologies that engage virtual communication and collaboration. This changing concept of the learning environment has clear implications for schools, where learning is the key focus of the space” (Johnson et al. 2010, 4).

The school library learning environment is more than a setting that connotes a physical space and nurturing climate; it has become a multidimensional context for multidisciplinary learning. Consideration of this context embraces the definition of the classroom learning environment proffered by Barry Fraser, who states that “learning environment refers to the social, psychological and pedagogical contexts in which learning occurs and which affect student achievement and attitudes” (1998a, 3). With this definition as a basis for exploring how the learning environment affects student outcomes, an examination of school libraries and science classrooms reveals that the methodology for assessing a science classroom environment can be extended to the school library setting.

Common Focus

School librarians and science teachers face the challenge of providing environments that are learner focused and positively affect the development of student literacy skills, as depicted in figure 1. With a national emphasis on requisite science literacy skills, the opportunity exists to strengthen collaboration efforts in this underserved area and examine the relationships among science programs, library programs, and student achievement.

Developing these literacy skills reflects learning theories such as constructivism, where we construct meaning from our experiences, and brain-based learning theory that
proposes that people learn better in a challenging, safe, comfortable, social and enriched environment (Caine and Caine 1991). Learning environments that reflect these theories are learner-centered, collaborative, cooperative, and experiential. School librarians and teachers in these environments serve as facilitators more than as instructors, motivating and inspiring learners to realize personal goals and achievement. Constructing and maintaining these learning environments enable the realization of the Standards for the 21st-Century Learner where learners use skills, resources, and tools to:

"1. Inquire, think critically, and gain knowledge.

2. Draw conclusions, make informed decisions, apply knowledge to new situations, and create new knowledge.

3. Share knowledge and participate ethically and productively as members of our democratic society.

4. Pursue personal and aesthetic growth" (AASL 2007, 3).

Learning environments that facilitate student learning and achievement also provide the means to meet the framework for 21st-century learning environments identified by the Partnership for 21st Century Skills:

- Creates learning practices, human support and physical environments that will support the teaching and learning of 21st century skill outcomes
- Supports professional learning communities that enable educators to collaborate, share best practices and integrate 21st century skills into classroom practice
- Enables students to learn in relevant, real world 21st century contexts (e.g., through project-based or other applied work)
- Allows equitable access to quality learning tools, technologies and resources
- Provides 21st century architectural and interior designs for group, team and individual learning
- Supports expanded community and international involvement in learning, both face-to-face and online” (2004).

School systems are challenged to accomplish standardized test goals and societal expectations throughout the school’s learning community, creating potential tensions in the relationships between teachers and students as goals are set and standards are imposed. Within the classroom and the school library, the psychosocial, institutional, and intellectual contexts are amenable to change, while the physical learning environments may be constructed to support these changes. Conducting research that assesses key dimensions of the classroom and library learning environment provides evidence of the classroom and school library practice that supports student achievement.

Research History
As we move forward with the AASL’s Standards for the 21st Century Learner (2007), consideration of the elements necessary to build and maintain an optimal learning environment that supports, encourages, and advances student learning and achievement will be a prominent theme.

A significant body of learning environment research is available within the education arena, tracing back to the foundational works about relationships between the environment and human behavior by Kurt Lewin (1936) and Henry A. Murray (1938). As the field of learning environment analysis progressed, the design and administration of educational environment assessment instruments advanced. During the 1960s and 1970s, Herbert Walberg
developed the *Learning Environment Inventory* (LEI) for an evaluation of Harvard Project Physics (Walberg and Anderson 1968), and Rudolf Moos (1974) developed his *Classroom Environment Scale* (CES). These evaluation instruments include and assess three basic dimensions:

1. relationships—the nature and intensity of personal relationships within the environment and the extent to which people support and help each other;
2. personal development—basic directions along which personal growth and self-enhancement tend to occur; and
3. system maintenance and system change—the extent to which the environment is orderly, clear in expectations, maintains control, and is responsive to change.

The assessment tools were developed to determine how individuals and groups of individuals react to their environment, to investigate what factors can affect their reaction to the environment, and to explore associations between the environment and student outcomes.

Exploring the association of student outcomes to measurement of student perceptions of the actual classroom environment and the environment preferred by students provides the opportunity to connect student achievement to a psychosocial environment. The field of science education, nationally and internationally, has used modified versions of these original evaluation instruments for many years (Fraser 1998b); a further modification recently introduced can be used to study the concept of learning environments in a school library setting.

### Current Research

A series of studies that examined the application of a *learning environment* paradigm to the school library setting in a north Texas school district revealed that science classrooms and school libraries can be assessed along common dimensions (Schultz-Jones and Ledbetter 2009, 2010). Previous studies revealed that positive learning environments contribute to high student outcomes in the science classroom. Because previous research also reveals that students in settings with strong school library programs have high student achievement, the role that a learning environment plays within the school library is worth examining for dimensions that could be assessed and modified as needed.

In one elementary school with science classroom students in grades 3, 4, and 5, the north Texas study examined the relationships among student perceptions of what they prefer, and what they believe is happening in their science classroom and in their school library setting to identify common themes. Highlights of the results include the following:

- Students want a science classroom and a school library that use cooperative work rather than competitive operations.
- Students do not enjoy a science classroom or a school library where friction occurs among or between students.
- Students perceive a different learning environment in the two places (school library and science classroom) and actually like some aspects of one more than the other.
- Third- and fourth-graders prefer more competition in the science classroom, while the fifth-graders perceive more competition in the actual science classroom.
- Fourth-graders notably perceive more satisfaction in the science classroom than in the school library, and more difficulty in the school library than in the science classroom.
- Third-graders prefer and experience more friction in the science classroom.
- Fifth-grade students are more satisfied with their science classroom learning environment than with the school library learning environment.
- Third-graders are more satisfied with the school library learning environment, finding significantly more friction in the science classroom than in the school library and more cohesiveness in the actual school library.
- Correlation analyses demonstrates that students’ perceptions of their satisfaction correlate negatively with the amount of friction, competition, and difficulty, and correlate positively with cohesion.

These results provide an opportunity for collaboration between the school librarian and the science teachers. Examining the dimensions and various perceptions across three grade levels provides data for reflective consideration at each grade level.
Establishing common goals and coordinated strategies to enhance the learning environments in both the science classroom and the school library will strengthen the support for science learning initiatives.

Does this enhanced learning environment matter in terms of student achievement? To answer that question, the learning environment data were used to correlate against the 2009 standardized state test results. Highlights of the correlation results include the following:

- For all grade levels regardless of learning environment, there is a positive correlation between reading and mathematics.
- In the fourth grade, reading also holds a positive correlation to writing.
- In the fifth grade, reading is positively correlated with science. The value and importance of reading skills applies across the grades and across the curriculum.
- For the third-grade actual school library results, reading negatively correlates to difficulty, and in the fourth-grade actual school library results, reading negatively correlates to friction. Because reading demonstrates a consistent correlation to achievement in mathematics, writing, and science, the incidence of negative correlations warrants attention.
- The negative correlation in the third-grade actual school library results of friction to mathematics and difficulty to mathematics also suggests a less desirable learning environment for these students.
- While the students in this school are considered high achievers for the school district, a more positive learning environment in the school library could contribute to higher achievement.
- For the science classroom, no negative correlations for reading, writing, mathematics, or science were identified.

Knowledge of student perceptions and correlated results with standardized testing could guide the evolution and improvement of the learning environment, with emphasis on key dimensions where significant differences occur. Assessment of a school library learning environment could be a key factor in determining the success of new teaching methods and resources. These results indicate a promising start to the application of this new paradigm to the school library setting.

**Evaluation Tool**

A standard learning evaluation instrument *My Class Inventory* (MCI) was selected for the north Texas study to investigate the two hundred elementary-grade students’ perceptions of their actual and preferred learning environments in the science classroom and the school library. This validated and reliable instrument was developed for use at the elementary school level for children aged 8–12 (Fraser 1998c) for the assessment of students’ perceptions of constructivist classroom learning environments.

The MCI was administered in two sittings. The science teachers distributed and collected the first set of paper questionnaires that focus on the preferred learning environment for the science classroom, and a week later, for the school library. Following a substantial time gap of several weeks, the science teachers conducted a second administration that provided the same set of questions with attention on the actual learning environment in both the science classroom and school library. This enabled a comparison between what the students prefer to experience and what is actually occurring in these learning environments.

<table>
<thead>
<tr>
<th>SCALE NAME</th>
<th>ITEMS PER SCALE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>5</td>
<td>Degree to which students enjoy learning and their class</td>
</tr>
<tr>
<td>Friction</td>
<td>5</td>
<td>Degree to which students do not get along or are unfriendly to each other</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>5</td>
<td>Degree to which students compete with classmates</td>
</tr>
<tr>
<td>Difficulty</td>
<td>5</td>
<td>Degree to which students experience difficulty in their learning tasks</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>5</td>
<td>Degree to which students feel a sense of belonging</td>
</tr>
</tbody>
</table>

Knowledge of student perceptions and correlated results with standardized testing could guide the evolution and improvement of the learning environment, with emphasis on key dimensions where significant differences occur. Assessment of a school library learning environment could be a key factor in determining the success of new teaching methods and resources. These results indicate a promising start to the application of this new paradigm to the school library setting.

**Evaluation Tool**

A standard learning evaluation instrument *My Class Inventory* (MCI) was selected for the north Texas study to investigate the two hundred elementary-grade students’ perceptions of their actual and preferred learning environments in the science classroom and the school library. This validated and reliable instrument was developed for use at the elementary school level for children aged 8–12 (Fraser 1998c) for the assessment of students’ perceptions of constructivist classroom learning environments.

The MCI was administered in two sittings. The science teachers distributed and collected the first set of paper questionnaires that focus on the preferred learning environment for the science classroom, and a week later, for the school library. Following a substantial time gap of several weeks, the science teachers conducted a second administration that provided the same set of questions with attention on the actual learning environment in both the science classroom and school library. This enabled a comparison between what the students prefer to experience and what is actually occurring in these learning environments.
The twenty-five-item MCI delivered the questions in blocks of five items in each of the five climate scales of: Satisfaction, Friction, Competition, Difficulty, and Cohesion. The answer format provided was a choice of Yes, Don’t Know, or No. The MCI used in the science classroom was modified for the school library setting by replacing the terms "science classroom" with "school library" and "doing schoolwork" with "finding resources (such as books and magazines)." The description of the MCI used is provided in Table 1. Examples of each of the preferred and actual scales for the MCI in the science classroom and the one used in the school library are shown in Table 2.

The data were analyzed against the learning environment dimensions for the science classroom environment and the school library environment, with t-test analyses. Then the data were analyzed using Pearson r for a correlation between students' library experiences and their science classroom experiences. The statistical analysis revealed several dimensions where the preferred learning environment did not coincide with the students’ perceptions of the actual learning environment, both in the science classroom and in the school library. Further confirmation of the research results was acquired through debriefing discussions with the teachers, school librarians, and administrators, as well as via observational opportunities. Strategies were discussed, and a schedule for yearly assessment was established.

**Climate Scales**

On the MCI the climate scales assess a range of interactions and personal experiences. Improving the learning environment and closing the gap between what is preferred and what is actually happening involve personal reflection and could initiate feedback from the students. In essence, school librarians become action researchers as they assess the learning environment over which they exert influence and identify possible intervention strategies.

1. **Satisfaction** is defined as the feeling of accomplishment and enjoyment with the learning environment. Many factors can influence students’ overall satisfaction including time to pursue personal interests and a welcoming atmosphere.

2. **Friction** includes conflicts between and among students. An atmosphere of tension and aggressive behaviors can disrupt a positive orientation towards research and learning.

3. **Competitiveness** is the perception that if one student wins, others lose. Favoritism may be perceived at the individual or class level, or there may be a sense of being rushed through the process of identifying and locating resources.

**INTERVENTION STRATEGY:** School librarian presents a welcoming presence, knowledge of information resources, and willingness to engage with student interests and assignments.

**INTERVENTION STRATEGY:** School librarian takes prompt and positive action to intervene in aggressive interactions.

**INTERVENTION STRATEGY:** School librarian spends time with all students and structures class instruction to be inclusive.

### TABLE 2

Examples of the Five Scales from the MCI Used to Evaluate the Learning Environments of the School Library and the Science Class

<table>
<thead>
<tr>
<th>MCI SCIENCE PREFERRED</th>
<th>ACTUAL</th>
<th>MCI LIBRARY PREFERRED</th>
<th>ACTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>In my science class, the students would enjoy their schoolwork.</td>
<td>The students enjoy their schoolwork in my science class.</td>
<td>Students would enjoy doing their schoolwork in the library.</td>
<td>Students enjoy doing their schoolwork in the library.</td>
</tr>
<tr>
<td>In my science class, the students would be always fighting with each other.</td>
<td>Students are always fighting with each other.</td>
<td>Students would always fight or argue with each other in the library.</td>
<td>Students are always fighting with each other in the library.</td>
</tr>
<tr>
<td>In my science class, the students would often race to see who can finish first.</td>
<td>Students often race to see who can finish first.</td>
<td>Students would often race to see who can find things in the library.</td>
<td>Students often race to see who can find things in the library.</td>
</tr>
<tr>
<td>In my science class, the work would be hard to do.</td>
<td>In my class, the work is hard to do.</td>
<td>In my library, finding different resources (such as books, magazines, CD) would be hard to do.</td>
<td>In my library, finding different resources (such as books, magazines, CD) is hard to do.</td>
</tr>
<tr>
<td>In my science class, everybody would be my friend.</td>
<td>In my class, everybody is my friend.</td>
<td>In my library, everybody would be my friend.</td>
<td>In my library, everybody is my friend.</td>
</tr>
</tbody>
</table>
4. **Difficulty** is assessed based on the degree to which students perceive that the library has a difficult learning environment. Access to resources and inquiry skills influence the perceived level of difficulty. If resources are easily accessible for specific needs, and students feel competent to locate and use those resources, the school library environment may be seen as challenging but not difficult.

**Intervention Strategy:**
School librarian collaborates with the science teacher to identify research projects and appropriate resources, combined with guidance to develop and reinforce reading and inquiry skills.

5. **Cohesiveness** is the perception that students are friendly and can work together. Research projects that require group work are instances where contributing and communicating with peers is encouraged. The degree to which these behaviors are supported in the school library can elicit a positive or negative response.

---

**Barbara Schultz-Jones** is assistant professor for the School Library Program of the Department of Library and Information Sciences within the College of Information, Library Science and Technologies at the University of North Texas. A primary focus of her research is the application and assessment of the learning environment paradigm in the school library. She is a member of the ALA program committee to introduce the new cataloging standard, RDA. Her publications include the 2006 book, An Automation Primer for School Library Media Centers and Small Libraries (Linworth).

**Intervention Strategy:**
School librarian provides time and space for group work and spends time with small groups encouraging positive debate and problem solving.

**Assessment**
The extent to which the elements of a positive learning environment are anchored will depend on the orientation and personal behavior a school librarian exhibits. Assessing the relationship between this behavior and student learning outcomes can be used as a method to determine the impact of the current learning environment, new teaching methods, staffing changes, and changes to the physical or virtual access to resources. Differences between student perceptions and teacher or librarian perceptions of actual and preferred environments can be the basis for reflection on and discussion of how to improve the learning environment. The potential for measuring and improving the learning environment indicates that this methodology can contribute to the research on the positive impact of school libraries on student achievement.

With a variety of opportunities and responsibilities for meeting the learning needs of students, school librarians can develop and nurture an optimal learning environment that makes a positive and measurable contribution to the educational process.

---

**Works Cited:**


Since 2003 the Speak Up National Research Project has surveyed students, educators, and parents about the use of technology in and out of school for learning. Speak Up provides the nation with unique insights about how technology is used to enhance student achievement, teacher effectiveness, and overall educational productivity. Most notably, the Speak Up data first documented and continues to reveal each year the increasingly significant “digital disconnect” between our nation’s students’ values and aspirations about the use of technology for enhanced learning and improved student outcomes, and the values and aspirations of their less-technology-comfortable teachers and administrators.

Regardless of community demographics, socioeconomic backgrounds, gender, or grade, students continue to tell us that the failure to use emerging technology tools in school is, in fact, holding back their education and, in many ways, disengaging them from learning. In many communities and states, the hard realization that today’s classroom environment does not mirror the way students utilize technology outside of school—notor prepare them to participate, thrive, and compete in the 21st-century economy—actually exacerbates the existing relevancy crisis in American education.

The Speak Up 2009 national findings paint a vivid picture of this continuing digital disconnect. These results also advance the premise, introduced with the Speak Up 2008 data, that if we listen to what’s important to students, we can facilitate learning environments that resonate with them. Students rapidly assimilate and adapt new technologies used in their personal lives to drive increased productivity in their learning and are, in essence,
functioning as a "digital advance team" for the rest of us. Through the Speak Up 2009 findings, we give voice to a genuine "student vision" for learning, particularly the students’ experience-based blueprint for the role of emerging technologies in 21st-century education, both in and out of the classroom.

About the Speak Up National Research Project and Speak Up 2009

Speak Up is a national initiative of Project Tomorrow, the nation’s leading education nonprofit organization dedicated to ensuring that today’s students are well prepared to be tomorrow’s innovators, leaders, and engaged citizens. Since fall 2003 the Speak Up National Research Project has annually collected and reported the views of more than 1.85 million K–12 students, teachers, administrators, and parents representing more than 23,000 schools in all 50 states. The Speak Up data represent the largest collection of authentic, unfiltered stakeholder input on education, technology, 21st-century skills, schools of the future, and science and math instruction. Education, business, and policy leaders report regularly using the data to inform federal, state, and local education programs.

In fall 2009 Project Tomorrow surveyed 299,677 K–12 students, 26,312 parents, 38,642 teachers, 1,987 pre-service teachers, and 3,947 administrators, representing 5,757 schools and 1,215 districts including...
public (97 percent) and private (3 percent) schools. Schools were located in urban (38 percent), suburban (31 percent), and rural (32 percent) communities. More than one-half of the schools were Title I eligible (an indicator of student population poverty), and 42 percent of the participating schools had more than 50 percent minority population attending.

**Students Empowered as “Free Agent Learners”**

The Speak Up 2009 National Findings provide compelling evidence that our nation’s K–12 students are increasingly taking responsibility for their own learning, defining their own education path through alternative sources, and feeling not just a right but a responsibility for creating personalized learning experiences. This “Free Agent Learner” student profile is not a future unattainable persona for students but rather describes the way many students are approaching learning. For these students, the schoolhouse, the teacher, and the textbook no longer have an exclusive monopoly on knowledge, content, or even the education process. As such, it should not be surprising that students are leveraging a wide range of learning resources, tools, applications, outside experts, and each other to create learning experiences that meet their educational goals.

The Speak Up 2009 survey reveals how technology enables students to seek out opportunities to learn on their own—not directed by a teacher, nor as part of a class assignment, nor homework. In their quest to personalize their learning, students seek out other students for collaboration, share information or tutor via Facebook, take online assessments and tests to evaluate their understanding of a particular topic, or use cell phone applications for self-organization and productivity. They also take online classes, not for a grade but to learn more about subjects that interest them, access podcasts and videos to get help in classes where they are struggling, and find experts (including other students) to connect with online to exchange new ideas and explore content in a myriad of new ways. These students are not necessarily waiting for our schools to provide the tools or applications (or even for national policy to suggest a new vision) to do this; instead they are embracing their educational destiny and creating their future by adapting for learning the tools, applications, and technologies that best work for them.
Creating Our Future: Students Speak Up about their Vision for 21st Century Learning

In Project Tomorrow’s report, Creating Our Future: Students Speak Up about their Vision for 21st Century Learning, students identify three essential elements in their vision for learning. At the heart of each element is the innovative use of a wide range of emerging technologies including online learning, mobile devices, Web 2.0 tools, and digital content. While these three essential elements represent some dramatically new approaches to teaching and learning in a classroom setting, for students the incorporation of the tools and applications is merely a natural extension of the way they are currently living and learning outside of that classroom. Thus, there exists a very special opportunity to both increase the relevancy of a student’s learning experience and start to close the persistent digital disconnect between students and educators. The key to unlock this opportunity is the long-overdue realization that students’ ideas about how to effectively leverage technology for learning can provide meaningful insights and even present a clear pathway for implementation.

Defining the essential elements is the first step to realizing their vision:

**Social-based learning**—Students want to leverage emerging communications and collaboration tools to create and personalize networks of experts to inform their education process.

**Untethered learning**—Students envision technology-enabled learning experiences that transcend the classroom walls and are not limited by resource constraints, traditional funding streams, geography, community assets, or even teacher knowledge or skills.

**Digitally rich learning**—Students see the use of relevancy-based digital tools, content, and resources as a key to driving learning productivity, not just as a method for engaging students in learning.

The full report, available on the Project Tomorrow website (<www.tomorrow.org>), highlights a selection of Speak Up findings that demonstrates how students are currently leveraging emerging technologies to implement their vision. The findings also illustrate how their aspirations for using technology more effectively for learning can be a catalyst for transformational change in our nation’s classrooms.

**Essential Element 1: Social-Based Learning**

Students want to leverage emerging communications and collaboration tools to create and personalize networks of experts that inform their education process. Students value social-based learning, and the Speak Up 2009 data provide new insights into how students use advanced communications and collaboration tools in their personal, technology-infused lives and for schoolwork. Outside of school, the majority of high school (72 percent) and middle school (65 percent) students communicate with others via IM, e-mail, or text messaging. Interestingly, 43 percent of high school students and 32 percent of middle school students report communicating with others through social networking sites or online communities. Of special significance, outside of school, 51 percent of middle school students and 59 percent of high school students report their primary vehicle for communicating with their friends online is through their social networking sites. Students report using the same tools to communicate and collaborate for school-related work—however, to a lesser degree (see figure 2 on page 24).

While students are developing these skills outside of school, many schools are not taking advantage of the tools or the students’ knowledge about how to use these tools within the classroom. About one-third of middle school and high school students report that two major obstacles to using technology more effectively at school is their inability to access personal communications accounts or send messages to classmates during the school day. Not surprisingly, therefore, one-third of middle and high school students want their schools to provide access to students’ personal communications accounts and their social networking sites. Notably, one-third of middle and high school students also want their schools to provide these tools so that they can electronically communicate with teachers.
The student vision for socially based learning is not divorced from curriculum or content. In fact, when asked to describe what instructional techniques or methodologies would be most helpful in learning math, 47 percent of middle school students and 40 percent of high school students selected “discussing how to solve a problem with my classmates” and “helping other students with their math problems.”

This social-based approach to learning also applies to how the students want to learn about careers in the science, technology, engineering, and math (STEM) fields. Some of the top student responses for high school and middle school students included: meeting successful role models (55 percent, 58 percent), talking to professionals about their jobs (54 percent, 52 percent), and working with mentors (41 percent, 35 percent) who can help with college and career planning.

School librarians can be effective allies in helping students realize their vision for a socially based learning environment. The Speak Up 2009 data reveal that school librarians have experience with collaboration tools such as blogs, social networking sites, wikis, and bookmarking tools, and are more likely than classroom teachers to use these tools to enhance student achievement.

**Essential Element 2: Untethered Learning**

Students envision technology-enabled learning experiences that transcend the classroom walls and are not limited by resource constraints, traditional funding streams, geography, community assets, or even teacher knowledge or skills. Student access to technology has shifted where and how learning can take place, expanding the definition of the traditional classroom. Students continue to report they have access to a wide variety of electronic devices for their own use, including desktop, laptop, or netbook computers, as well as cell phones and smart phones (see table 1).

Access to Internet resources, via a wide range of devices, enables students to expand the walls of their

### Table 1: Percentage of Student Access to Electronic Devices

<table>
<thead>
<tr>
<th>Device Type</th>
<th>K – 2</th>
<th>G3 – 5</th>
<th>G6 – 8</th>
<th>G9 – 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Phone with Internet access</td>
<td>14</td>
<td>17</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>Cell Phone without Internet access</td>
<td>18</td>
<td>29</td>
<td>59</td>
<td>67</td>
</tr>
<tr>
<td>Laptop / Tablet PC / Netbook</td>
<td>27</td>
<td>32</td>
<td>53</td>
<td>70</td>
</tr>
<tr>
<td>Desktop</td>
<td>37</td>
<td>41</td>
<td>67</td>
<td>74</td>
</tr>
<tr>
<td>iPod</td>
<td>35</td>
<td>55</td>
<td>80</td>
<td>85</td>
</tr>
</tbody>
</table>

**Figure 2.** Students use a variety of tools to collaborate and communicate about school-related work.

- Communicate with students (via email, IM, text or chat)
- Collaborate through profile
- Communicate with teachers (via email, IM, text or chat)
- Post to blogs or wikis
- Tweet or post a microblog
- Participate in online communities
- Get help from an online tutor
- Participate in videoconferences
classroom, exploring and learning at their own pace and in their own time. As a result, students who are concerned about the lack of resources in their own community, the quality or effectiveness of their teachers, or the relevancy of their textbooks have the freedom to seek out online resources. In that sense, untethered learning enables students to use the best educational content and learning experiences, wherever the resources may be in the world.

**Essential Element 3: Digitally-Rich Learning Experiences**

Students see the use of relevancy-based digital tools, content, and resources as a key to driving learning productivity, not just about engaging students in learning. Young people use sophisticated digital media, tools, and content in most aspects of their lives. Not surprisingly, therefore, today’s youth are consummate documentarians of their lives as they are unfolding. With photos, videos, blog entries, lists of favorites, explicitly named networks of friends and colleagues, status postings and rankings from online games, and opinions on just about everything that occurs in their universe, students can create strong online presences. Technology-enabled resources and applications are highly engaging for students and, when effectively integrated within instruction, empower students to be self-directed and productive. The Speak Up data highlight students’ use of digital media tools, content, and resources for learning, and provide insight about student preferences for digitally rich learning environments.

Our students’ enthusiasm for online textbooks illustrates their desire to use a variety of tools in their personalized learning environment. Along with tools to facilitate communication, collaboration, and personal productivity, students desire access to online tutors and digitally rich tools such as: games, animations and simulations, videos, links to real-time data, and virtual labs. They also want tools to create content such as podcasts and videos (see figure 3).

**FIGURE 3. Students want their online textbooks to be digitally rich and up to date.**

![Figure 3: Students want their online textbooks to be digitally rich and up to date.](image-url)
Although the digitally rich learning environment represented by games and online textbooks is widely supported by both students and parents, teachers’ actual use of digital resources lags behind students’ aspirations. Currently, teachers primarily use digital teaching aids in their classroom such as lesson plans, test-prep software, or websites (66 percent). Fewer teachers use games (26 percent) or online textbooks (23 percent). Less than 12 percent of teachers incorporate into their classroom instruction interactive simulations desired by two-thirds of parents and a majority of high school students.

This disconnect is even more pronounced when we examine how students want to learn math. When asked to identify the teaching strategies that would be most helpful in learning math, high school students selected the following digital tools as most effective:

- using interactive simulations to solve math problems (37 percent)
- using online or computer based math games (40 percent)
- using animations to help me visualize difficult concepts (34 percent)

Additionally, one-half of middle and high school students selected learning math by solving real-world problems as the most effective strategy.

Students’ experiences in math are echoed in science. Speak Up 2008 data highlight students’ desire to learn science using “real tools” (such as standard lab and technology-based tools) and conducting “real research,” including online research on computers. For middle school and high school students, animations for visualizing difficult concepts and interactive simulation tools are also important.

These examples highlight the real value that students place on learning in a digitally rich environment and underscore why it is an essential element in their vision for education. Whereas students will concede that incorporating technology into learning does increase their own engagement and motivation for learning, it is equally important to realize that emerging technologies such as games and online textbooks increase their personal productivity, as well. Using

### PROJECT TOMORROW <WWW.TOMORROW.ORG>

Project Tomorrow, a national nonprofit organization located in Irvine, California, promotes the use of innovative and research-based uses of science, math, and technology resources in our K–12 schools to develop critical thinking, problem solving, and creativity skills in students. Its Speak Up National Research Project has surveyed over 1.85 million students, educators, and parents about their aspirations and use of technology in and out of school for learning, science/math instruction, 21st-century skills, and STEM career exploration.

Laurie Smith is the director of research and evaluation for Project Tomorrow. She has primary responsibility for facilitating the Speak Up National Research Project. She has coauthored several Speak Up reports, including “Creating the Future: Students Speak Up about their Vision for 21st Century Learning” and “Unleashing the Future: Educators Speak Up about Using Emerging Technologies in the Classroom.” Smith works with state education technology directors, district and school staff, and various organizations to effectively integrate the Speak Up data into their initiatives.

Julie Evans is the CEO of the national education nonprofit organization Project Tomorrow. A nationally recognized leader in education technology, youth development, and nonprofit management, in April 2008 Evans was named by eSchool News as one of the ten most influential people in education technology over the past ten years. For the past decade, Evans has been a regular speaker and workshop leader at many K–12 and higher education conferences in the United States and Canada.
technology as part of learning is an essential business practice for today’s students, not just an add-on for skill development or motivation.

Ending Thoughts

Each year through the Speak Up survey, focus groups, and panel discussions, we ask our nation’s students to envision their ultimate school. The data and our subsequent conversations point to one resounding fact: though often not explicitly stated, our nation’s students already have a plan in mind and are effectively leveraging technology to create their own vision for a 21st-century learning. Students want to interact and learn from their own personalized network of experts, using cutting-edge communications and collaboration tools. They learn 24–7 and want tools and processes that are not tethered to time, place, and geographic boundaries. They also recognize, from their own experiences, that the best way to facilitate their learning and productivity is through the effective use of rich and relevant digital tools, content, and resources.

Speak Up has a rich tradition of informing local, state, and national policies, and we encourage you to think about how you might leverage the Speak Up data to inform your practice. The Speak Up data reveal that school librarians have the skills needed to help students realize their vision for untethered, socially based, digitally rich learning experiences. To what extent does your current program provide access to and support for students’ preferences for learning? What challenges do you face in participating in these educational trends? What opportunities do you feel these aspects of 21st-century learning provide to your practice as a school librarian or the conception of your school library?

Inspired by President Obama’s “Educate to Innovate Campaign,” which promotes a renewed focus on Science, Technology, Engineering, and Math (STEM) education, the first annual National STEM Video Game Challenge aims to motivate interest in student learning by tapping into youth passion for playing and making video games.

Created by the Joan Ganz Cooney Center at Sesame Workshop and E-Line Media, this challenge seeks the submission of ideas and designs for educational video games from any middle school student (grades 5-8) in the United States.

“Children of all ages are immersed in technology—today’s kids spend as much time with digital media as they do in school. With the need to make learning both more engaging and productive, we need some real game changers,” said Michael Levine, executive director of the Joan Ganz Cooney Center.

The National STEM Video Game Challenge exemplifies active learning as found in the AASL Standards for the 21st-Century Learner. The challenge, like the standards, helps learners develop the skills, attitudes and responsibilities needed to succeed in a rapid-paced, global society.

As a partner in the challenge, AASL encourages all school librarians to help their middle school students to participate in the competition. Winners in 14 categories will receive a prize package that includes a laptop computer and subscriptions to Gamestar Mechanic and BrainPop. In addition to individual prizes, the schools or non-profit organizations designated by the winners will be awarded $2,000 ($3,000 if the school is a recipient of Title 1 funding from the U.S. Department of Education). Submissions are due by January 5, 2011.

For more information and submission guidelines for the National STEM Video Game Challenge, visit www.stemchallenge.org. You can also read an interview about the challenge with Alan Gershenfeld, founder and president of E-Line Media, at www.ala.org/aasl/knowledgequest.

To read or download a copy of the AASL Standards for the 21st-Century Learner, visit www.ala.org/aasl/guidelinesandestandards.
As educators, we know that students learn better and faster when they are actively engaged in their learning. Digital media can be a great vehicle for student engagement with classroom technology in the science, technology, engineering, or math (STEM) classroom.

Why use media to teach STEM? Although media cannot replace hands-on learning, it can strengthen learning in any STEM classroom. Media can illustrate scientific concepts, showcase the design process, introduce robotics, model three-dimensional geometric figures, and connect students to real-life STEM careers. Media can be a powerful tool that sparks curiosity, promotes scientific inquiry and critical thinking, and helps students make connections between their experiences and the content to be learned. Overall, media can help reinforce critical 21st-century skills. As the ambassadors to the schools’ learning resources and technology, school librarians are essential participants in media-rich learning.

Getting Started with Digital Media

Here are some tips for using digital media, like videos or interactives, in the classroom:

Preview the media to check the content, audio levels, and window size. If you are using a video from the Web, download it, if possible, to avoid Internet
connectivity problems, and remember to select “full-screen” mode whenever available.

Make ample use of the pause button. You can pause for discussion, to ask for predictions, to define a word, to make connections to students’ own experiences, or to highlight a point made in the video.

Replay the video. Students may not take in all the information in one viewing, so replay the video as needed. You can have students view the segment multiple times, asking them to focus on a different element each time.

Consider turning the volume off and allowing students to observe and comment on the images or predict the content of the narration.

School librarians can work with teachers to facilitate small group discussions and brainstorm extension activities.

**Teachers’ Domain Exemplary Digital Media Resources**

Teachers’ Domain, a free online digital library, has a wealth of quality STEM resources—nearly three thousand videos, Flash interactives, audio segments, images, self-paced student lessons, and lesson plans for teachers that correlate to national and state standards—all available free of charge at [www.teachersdomain.org](http://www.teachersdomain.org). Teachers’ Domain resources come from popular PBS shows like *NOVA*, *Frontline*, *Nature*, *Quest*, and *Cyberchase*, and from other public television stations, universities, museums, and government agencies.

This fall Teachers’ Domain has created a newly designed website...
and new features that include full-screen video, search by standard, and accessibility features that make the media accessible to all users. The image in figure 1 is a snapshot of a resource page and the features available to registered users.

School librarians know that even the best media may be inaccessible because of unreliable Internet access in the classroom. We can work with our teachers to ensure that they have the necessary skills and resources to facilitate offline, as well as online, activities. About half of Teachers’ Domain resources can be downloaded onto a flash drive or a desktop to use offline. You can also share and edit (remix) resources to create media mashups. To identify what’s permissible for specific resources, look for these icons on the resource page or in search results listings:

Two of the most useful, yet often overlooked, features on Teachers’ Domain are Folders and Groups. As a registered Teachers’ Domain user, you can create folders that allow you to save and organize your favorite resources from the site, upload your own files, and link to other locations on the Web. (These features are not available to those simply “browsing” the site.) To create a new folder, simply click on “My Folders” at the top of any page. When browsing the site, you can save any resource into your folders by clicking on “Save to a Folder” beneath the resource image. “My Groups” allows you to share your folders with other users. When you create a group, it is assigned a four-digit identification code that can be shared with users invited to join your group. If you need help using folders, Teachers’ Domain provides tutorials that can be accessed directly from the homepage. Under Professional Development, click on “Teaching Strategies,” then click on “Using Teachers’ Domain and its Editions.” You will find several tutorials to help you master the process.

Teachers’ Domain can be used to extend learning outside the classroom. Teachers or librarians can create student accounts for their students, or if students are over the age of thirteen, they can register and create their own accounts. Parents can also create accounts for younger children or themselves to use outside of school. Teachers’ Domain resource pages include citations that allow students to easily use any resource as a source for a research paper or school project.

Here are some of the best STEM-themed collections available on Teachers’ Domain:

- **NOVA** [www.teachersdomain.org/special/nova](http://www.teachersdomain.org/special/nova)
- **Nature** [www.teachersdomain.org/special/nat](http://www.teachersdomain.org/special/nat)
- **Cyberchase** [www.teachersdomain.org/special/cyb](http://www.teachersdomain.org/special/cyb)
- **NOVA scienceNOW** [www.teachersdomain.org/special/nsn](http://www.teachersdomain.org/special/nsn)
- **Judgement Day: Intelligent Design on Trial** [www.teachersdomain.org/special/evol07-ex](http://www.teachersdomain.org/special/evol07-ex)
- **Advanced Technological Education** [www.teachersdomain.org/special/ate](http://www.teachersdomain.org/special/ate)
- **Biotechnology** [www.teachersdomain.org/special/biot](http://www.teachersdomain.org/special/biot)
- **Polar Sciences Collection** [www.teachersdomain.org/special/ipy07-ex](http://www.teachersdomain.org/special/ipy07-ex)

**Cool Careers in Science**
[www.teachersdomain.org/special/city07-ex](http://www.teachersdomain.org/special/city07-ex)

**Where Words Touch The Earth**
[www.teachersdomain.org/special/nasawords](http://www.teachersdomain.org/special/nasawords)

**Engineering**
[www.teachersdomain.org/collection/k12/sci.engin](http://www.teachersdomain.org/collection/k12/sci.engin)

**Mathematics**
[www.teachersdomain.org/collection/k12/math](http://www.teachersdomain.org/collection/k12/math)

The Teachers’ Domain website is regularly updated with new features and media collections. To be added this year are an Environmental Health collection and twenty-five new self-paced student lessons that build middle school literacy in the content areas. As a registered user, you can subscribe to the monthly newsletter to learn about additions to Teachers’ Domain.

**Ideas for Staff Development**

Once you learn all about using Teachers’ Domain resources, you may want to offer a workshop to educate your staff on this valuable resource. Teachers’ Domain has downloadable workshop-facilitator’s guides on how to use Teachers’ Domain. To access the guides, go to the Teachers’ Domain homepage, click on “Teaching Strategies” under the Professional Development section, and then click on “Using Teachers’ Domain and its Editions.” For beginners, Introduction to Teachers’ Domain Workshop gives an overview of the website, including how to register and how to find, select, and use the online resources. Other workshops include Using Teachers’ Domain in the Classroom, Using Folders and Groups, Creating User-Generated Media, and Technology Guide to Teachers’ Domain.

School librarians are great partners for technology workshops and training. For staff development
These Teachers’ Domain professional development resources are great starters and structures that showcase the technology and resource leadership available in the school library. Occasionally, Teachers’ Domain will also offer free webinars or workshops at national or regional education conferences on topics such as media literacy, biotechnology, and digital media in the 21st-century classroom.

For teachers who are beginners at using digital media in the classroom, the Teachers’ Domain resource “Effective Video-based Lessons” describes the three essential parts of an effective media-based lesson: Frame, Focus, and Follow-up. These guidelines are similar to the well-known KWL Method that asks students to state what they know, what they want to know, and what they learned. These guidelines, created by EDC’s Center for Children and Technology and available with additional information at <www.teachersdomain.org/resource/vtlpd.pd.hints.frfofo>, consist of the following:

**Frame:** Provide a context that helps students pay attention to the main content of the video. Ask students questions about the topic explored in the video to activate prior knowledge. When necessary, tell students enough about the part of the story preceding the segment, so they can follow along.

**Focus:** Help students notice the important moments in the video by giving them something to look for while they watch. Without a focus for viewing, students see all sorts of interesting details—but not necessarily the idea or information you want them to focus on.

**Follow-up:** Provide an opportunity for students to summarize what they saw. They will see different things—and not always what you expected them to see! Retelling what they saw helps students consolidate their understanding and remember it.

These three guidelines provide a great way of introducing a topic, reinforcing it, and assessing student mastery of the material.

If you have any questions, or need additional help, Teachers’ Domain provides user support. Send e-mail to td_contact@wgbh.org or call (617) 300-3631. The website has FAQs on registering, navigating, or sharing resources <www.teachersdomain.org/faq.html>.

One of the most challenging tasks for school librarians is sorting through the surplus of media available for classroom use. Teachers’ Domain assists school librarians in helping teachers find a wealth of quality online resources in STEM. As school budgets get tighter, Teachers’ Domain can be a valuable tool used to enhance teaching and learning, without putting a hole in your pocket.

Daniella Quinones most recently authored “Utilizing Digital Media to Enhance Teaching and Learning” for the NSDL-funded online magazine Beyond Penguins and Polar Bears (see Jessica Fries-Gaither’s article in this issue). Before becoming a middle school teacher, Daniella led professional development workshops for teachers offered by WGBH’s Teachers’ Domain on topics that included media literacy, STEM, technology integration, and student-generated media projects.
BEYOND PENGUINS and POLAR BEARS

BRINGING THE POLAR REGIONS CLOSER TO HOME

Jessica Fries-Gaither
fries-gaither.1@osu.edu
Why don’t we teach about these amazing places and their importance to the global system? Often it’s because they are far away—both from our physical locations and from the science concepts that we are expected to teach. Or maybe it’s because we, as educators, don’t necessarily have a solid understanding ourselves.

Meeting these challenges and making polar science accessible to educators are the goals of Beyond Penguins and Polar Bears, a project funded by the National Science Foundation during the 2007–2009 International Polar Year. The project’s focus is preparing elementary school science teachers to teach polar science concepts, while also integrating inquiry-based science and literacy instruction. The project draws on research showing that an integrated approach can improve student achievement in science, as well as in reading comprehension and oral and written discourse abilities. Ultimately, the project seeks to bring the polar regions “closer to home” for elementary school teachers and their students.

Science and Literacy in an Online Magazine

At the heart of the project is an online magazine, or cyberzine, available at <http://beyondpenguins.nsdl.org>. Twenty issues of the magazine were published, and all remain available for free access by any user. Each issue is organized around a theme that connects the polar regions to the elementary school science curriculum. A sampling of themes includes: rocks and minerals; day, night, and seasons; the water cycle; and plants. Each issue also focuses on a reading comprehension strategy or other key literacy topic, such as determining importance, organizing and writing research reports, or drawing inferences and using context clues. Thematic issues, strong connections between the content and the elementary course of study, and alignment with national science and English language arts standards, as well as AASL’s Standards for the 21st-Century Learner, assist teachers in implementing resources in an already congested curriculum.

The content in each issue is organized into five departments:

1. **Professional Learning** showcases science and literacy content-knowledge articles, information about student misconceptions, strategies for teaching and assessment, and information about creating an equitable classroom environment.

2. **Science and Literacy** includes lesson plans, informational text written for students at grades K–1, 2–3, and 4–5 reading levels, and a virtual bookshelf of children’s literature.

3. **Across the Curriculum** includes ideas for incorporating math, social studies, and art activities.

4. **In the Field: Scientists at Work** profiles polar researchers.

5. **Polar News and Notes** connects users to the project blog for postings about polar news, research, and opportunities.

Vast ice sheets… Towering icebergs… The eerie beauty of the aurora… The polar regions—the Arctic and Antarctica—are fascinating for many reasons. Polar scientists tell us that in this era of climate change, understanding the polar regions is more important than ever. Yet the topic is not often included in school curricula or is limited to a study of school mascots, like penguins and polar bears.

Volume 39, No. 2 | November/December 2010 35
Look, Listen, and Learn

Multimedia is also used to make the polar regions more accessible to the project’s users. A series of twelve podcasts takes listeners to Baffin Island to record bird calls, to Greenland to study ice sheets, and to the bottom of the world with a middle school teacher. A polar photo gallery provides a wide variety of engaging images of the Arctic and Antarctica, and includes copyright and use information to help users understand how they can use the images in their classrooms.

In addition, a partnership with the National Science Digital Library (NSDL) project Content Clips (see Lois Mclean’s article in this issue) has allowed for the creation of electronic books from the informational text included in the magazine’s Science and Literacy department. Students can listen to the text as they read on-screen, learning about polar science and developing reading comprehension skills as they go. Highlighted vocabulary words have individually recorded definitions, serving as a glossary.

While integrating science and literacy is the main focus of the project, using Web 2.0 tools in the classroom is a key component. An “Integrating Technology” column provides guidance in effectively using blogs, wikis, social networking, podcasting, interactive whiteboards, and more. Web 2.0 tools such as Twitter (follow us at @beyondpenguins), Facebook <www.facebook.com/beyondpenguins>, and wiki pages are also used by project staff to disseminate information and share resources.

The magazine offers standards alignment to the National Science Education Standards and the NCTE/IRA Standards for the English Language Arts, the ability to browse the magazine by column, and the ability to translate the magazine into twelve different languages. Project staff are also uploading cyberzine content to MagCloud, a print-on-demand service from Hewlett-Packard. Users can order printed versions of cyberzine content or download content onto an iPad. Browse the content at <www.magcloud.com/user/DLatOSU>.

Future additions include an introductory video providing an overview of the magazine’s layout and content, as well as digital stories to accompany each issue.

Inquiry-Based Learning and Informational Text

While no new issues of the cyberzine are planned, the project staff...
continues to make updates to the existing issues to keep content current and to better serve the audience. One significant addition, in direct response to teacher feedback, is a set of unit plans for each issue—one plan for grades K–2 and another for grades 3–5. These plans help educators assemble the diverse set of resources found in any given issue into a cohesive, inquiry-based unit modeled after the 5E learning cycle framework: Engage, Explore, Explain, Expand, Evaluate.

While the specifics of the unit plans vary from issue to issue, all rely on an inquiry approach to learning science content as recommended by the AASL’s Standards for the 21st-Century Learner and on informational text. Research shows that reading informational text is crucial for the development of reading comprehension, content knowledge, and vocabulary, and can assist in the development of visual literacy through the use of charts, graphs, and diagrams—yet informational text is underrepresented in elementary school, particularly in the primary grades (Duke 2000). Research has also demonstrated that, in school libraries where the collection is rich with dynamic science information and images (like those found in magazines, cyberzines, and reference books), student learning in science is strong (Mardis and Hoffman 2007).

Each issue of Beyond Penguins and Polar Bears helps teachers discover high-quality and engaging informational text (both previously published and original). The cyberzine provides strategies and a context for inclusion in the classroom, and offers school librarians ways to enrich their nonfiction and magazine collections with updated, visually rich, and dynamic science text.

**Free Professional Development**

Another component of the project is providing opportunities for educators’ professional development. During the 2010–2011 school year the Beyond Penguins and Polar Bears project will sponsor a series of free monthly Web seminars in the areas of science and literacy. Of special focus are the many genres of informational text, inquiry-based instruction, and strategies for effectively integrating science and literacy in classroom instruction. Information on each seminar and how to participate is available at <http://wiki.nsdl.org/index.php/BeyondPenguins/Seminars>.

**Project Evaluation**

Early evaluation efforts for Beyond Penguins and Polar Bears have been positive. Since the cyberzine’s launch in March 2008, the site has registered more than 600,000 pageviews and 300,000 visits. Science, literacy, and education experts asked to review cyberzine issues commented that it “provides a substantive dialogue regarding how integrating science–literacy instruction can enhance teaching and learning” and that articles and ancillary resources were accurate, developmentally appropriate, and easily accessible for teachers and students. Reviewers also described the website as “beautifully designed, [containing] an enormous amount of helpful, practical information and...very well written” (Woodruff, Morio, and Li 2009, 4).

Preliminary pilot testing with fifteen elementary teachers in Columbus, Ohio, and Charlotte, North Carolina, demonstrated that teachers felt they increased their own content knowledge about the polar regions (as well as science in general), changed the science curriculum in their classroom and the ways in which they used educational technology, and gained confidence in teaching science to their students. Additionally, students whose teachers participated in pilot testing also benefited. Preliminary testing indicated...
statistically significant changes in third-grade students’ attitudes toward science. Following exposure to the Beyond Penguins materials and activities, they agreed less with the statement “Science is mostly memorizing facts” and more with the statement “Writing is important in science” (Woodruff, Morio, and Li 2010, 11).


Good Digital Citizens

Though the site and cyberzine are intended for elementary school educators, the project staff has found that the audience has expanded well past that original definition. Surveys, presentations, and informal conversations indicated that school librarians, homeschoolers, educators at informal science centers, and even middle and high school teachers are integrating resources from the project into their work.

The resources also assist teachers as they incorporate Web tools into their classrooms and help students become good digital citizens. The project seeks to model fair use and licenses all content with the Creative Commons Attribution-Share Alike 3.0 Unported license <http://creativecommons.org/licenses/by-sa/3.0>.

Resources from the Beyond Penguins and Polar Bears project support the AASL’s Standards for the 21st-Century Learner. The inquiry-based approach presented in the unit plans supports:

Standard 1: “Inquire, think critically, and gain knowledge”;

Standard 2: “Draw conclusions, make informed decisions, apply knowledge to new situations, and create new knowledge”; and

Standard 3: “Share knowledge and participate ethically and productively as members of our democratic society” (AASL 2007, 3).

AASL’s Standards for the 21st-Century Learner begin with the common belief that “reading is a window to the world” (2007, 2). By helping elementary classroom teachers and school librarians combine reading with hands-on science and multimedia tools, the Beyond Penguins and Polar Bears site is bringing the remote polar regions just a little bit closer.

Jessica Fries-Gaither is education resource specialist at Ohio State University, College of Education and Human Ecology, School of Teaching and Learning. She is also project director of Beyond Penguins and Polar Bears <http://beyondpenguins.nsdl.org>.

Works Cited:


Years ago, in the days before the Internet, a typical college assignment for prospective elementary school teachers was to build what was known as a picture file, typically a cardboard box filled with images clipped from old calendars and magazines, and organized according to common curriculum themes.

Once hired, a new teacher could use this file to supply illustrations for lessons and classroom discussions, and then add to it over the years. Even today, at the beginning of school and before the students arrive, many new and returning teachers drag roller bags filled with personal resource collections such as lesson plans, worksheets, and visual aids. Now, Internet connectivity is starting to lighten teachers’ loads by replacing many physical resources with links to free or low-cost online media.

Motivated teachers and school librarians can find excellent curriculum-related materials all over the Web. Some are available through dedicated educational sites such as the National Science Digital Library <http://nsdl.org>. Others are stored in the digital collections of government agencies such as NASA or found through searches of general sites such as Google, Flickr, and even YouTube. This online content comes in a wide variety of formats, including webpages, audio and video clips, images, animations, PDF files, and PowerPoint presentations.

Still, despite this almost instant access to a wealth of online multimedia content,
COOK UP CURRICULUM WITH CONTENT CLIPS
identifying appropriate high-quality resources and managing them for instructional use can still be a daunting challenge. In fact, because of the sheer volume of materials online, finding just those resources with educational potential may be a barrier for teachers, who have neither the time nor the search skills to sift through and organize them effectively. Elementary school teachers are particularly challenged to find high-quality, grade-appropriate materials for their students.

What is Content Clips?

Content Clips (CC) is a free online collection and service created to help elementary school teachers and school librarians find and save digital resources from multiple online sources and use the resources for educational purposes. And, unlike a picture file, the CC website <www.contentclips.com> offers much more than static images. Instead, it blends its digital collection of multimedia clips with a tool to mix resources into sets, interactive lessons, and presentations within an online visual workspace. It also provides a single, secure website where users can assemble their own personal collections, without the need for software programming skills, by linking to external online content tailored to their own curricula. Although Content Clips was designed with classroom teachers in mind, school librarians will also find its features useful.

The Content Clips project grew from a targeted research study funded by the National Science Digital Library (NSDL) program of the National Science Foundation (NSF). The project’s first goal was to investigate one key question: How can we make digital libraries and other online collections more useful for elementary science teaching?

To explore this topic, the project team, led by principal investigators Rick Tessman and me, began assembling a small collection of digital resources related to elementary life science topics and a prototype software system for delivering the resources online. During this research phase, elementary teachers at several school sites provided feedback concerning the factors that influence their choice of online resources and their reactions to the developing system. Currently, thanks to a follow-on NSDL grant, the CC team is broadening its efforts to cover additional elementary science topics, including physical and earth sciences, and to build new tools for sharing these resources with students (NSF DUE-0938120).

What Online Resources Do Teachers Want?

Results of two surveys, conducted during the Content Clips research phase, suggest that elementary school teachers want online resources that are kid-friendly, easy to find and use, grade-level appropriate, and match state standards and curriculum (Mclean and Tessman 2008). These findings echo those of Project TestDrive, a supplement to the Digital Libraries Goes to School project. Project TestDrive examined similar issues. In that study, a group of twenty-nine K–12 teachers selected 111 resources from NSDL collections to assemble lessons using Instructional Architect <http://ia.usu.edu>. Instructional Architect is a tool that helps teachers create simple webpages using links to online resources from the NSDL. Teachers’ selection criteria included: appropriate for classroom use, credible content, enhances current curriculum, aligns with state standards, and increased student engagement (Evans and Smith 2008).

In the Content Clips research study, one unexpected finding was the frequency with which study participants used online resources. Among eighteen respondents in 2007, 56 percent reported daily use of the Internet in classroom instruction, and 28 percent said they used online resources on a weekly basis. In the same survey, usage was 94 percent for online video clips, 83 percent for images, and 44 percent for animations (Mclean and Tessman 2008). In a final survey of twenty Project TestDrive participants, 50 percent reported choosing images and also said that they would use their chosen resources in whole-class activities.
Project Tomorrow surveyed more than 25,000 teachers for the 2007 Speak Up study, asking them which 21st-century tools they saw as "having the greatest potential to increase achievement in science." Top choices were "animations to help students visualize difficult concepts, interactive simulations, lab tools, projection systems, and electronic whiteboards" (Project Tomorrow and Pasco Scientific 2008).

The Content Clips research also indicated a strong shift toward Internet use in whole-class presentations (78 percent in 2007) and away from independent workstations, presumably because of a growing trend toward the purchase of projectors and electronic whiteboards (McLean and Tessman 2008). While electronic whiteboards have their detractors, perhaps because of fears about promoting teacher-directed learning over inquiry and exploration, electronic whiteboards can offer efficient and effective ways to share online resources. Evaluation of the CC site by elementary school teachers quickly made it evident that the system’s drag-and-drop presentation interface is ideally suited for use with these emerging technologies.

A Continuum of Granularity

As an NSDL collection, Content Clips differs somewhat from many other NSDL projects in its emphasis on granular objects and their reusability. Learning object granularity can be described as falling along a continuum from a single, stand-alone object, such as an image file, to a complete lesson, unit, or course of study. A granular object is likely to have wider applications than one with a very specific context and purpose (Wagner 2002). For example, a single image of a red-legged frog could be used in many settings and grade levels. A teacher might use it to illustrate a discussion of vertebrates versus invertebrates, amphibian characteristics, adaptations for protection, animal movement, protecting threatened species, global climate change, or forest habitats. On the other hand, within the context of a frog anatomy lesson, that same red-legged frog image may be a perfect resource for a high school biology course but would be out of place in a primary classroom.

Supporting a Continuum of Users

Content Clips users vary widely in the amount of time and effort they will invest and the features they will find most valuable. In discussing Instructional Architect, Mimi Recker describes her own experiences with having teachers take on the role of curriculum designers. She cites Brown and Edelson’s (2003) continuum of teachers’ curriculum use, which ranges from offloads to adaptations to improvisations.

"In offloads, the curriculum is implemented essentially unchanged and the bulk of instructional decisions are contained in the resources. In improvisation, the teacher flexibly borrows and customizes pieces, while playing the major role in the decision-making process. The adaptation category represents the mid point of the continuum" (Recker 2008, 6).

Content Clips supports users at any point along this continuum, with both its collection of carefully selected multimedia clips and a tool for users to assemble customized collections, learning activities, and classroom presentations.

Still, despite this almost instant access to a wealth of online multimedia content, identifying appropriate high-quality resources and managing them for instructional use can still be a daunting challenge.

In fact, because of the sheer volume of materials online, finding just those resources with educational potential may be a barrier for teachers, who have neither the time nor the search skills to sift through and organize them effectively.

Cooking with Content Clips

It is easy to get started with Content Clips. The only requirement is to register online and establish a personal account to save items that you add or create. For new users, a cooking metaphor often helps explain the CC “flavor” and features. The basic recipe has four key steps: FIND, ADD, MIX, and SERVE (see figure 1).

FIND the ingredients you have on hand. The published Content Clips collection, available to all registered users, includes images, video, interactives, websites, e-books, and text documents. On the Find tab, users can browse resources by common elementary science topics such as life cycles or mammals, or search by keyword or media type.
Because CC is an NSDL project, its resources are cataloged with standardized metadata (Dublin Core), including copyright information. Users can click on a thumbnail to view an actual object or click on a title to read the object’s metadata. A teacher interested in clips about mammals would find a range of resources, including images, interactives, videos, sounds, and e-books (see figure 2).

Some items in the published Clips Collection are drawn from other NSDL collections, such as the Exploratorium Digital Library (<www.exploratorium.edu/digital_library>) and Teachers’ Domain open educational resource collection (<www.teachersdomain.org>). Others are selected from photo sharing sites such as Flickr (<www.flickr.com>) or government agency collections such as the Antarctic Photo Library (<http://photolibrary.usap.gov>). Most resources on the CC website are in the public domain or have a Creative Commons license that allows them to be downloaded or shared, with attribution.

**ADD more ingredients to spice things up.** The published CC collection continues to grow and become more diverse, but users are not limited to working with just those resources that they find within it. Users can also build a personal clip collection by linking to external content. All it takes to start is to click on “Add New Clip,” and then enter a title and Web address (URL). Optional fields can be used to include a description or a default caption to be displayed with the clip. New clips are saved in My Content, the personal collection that is visible only to that registered user (see figure 3). The clip’s file format determines the way that the resource will be displayed within the CC presentation system. For example, if a URL address that begins with “http://” ends with the extension “.jpg,” then the link is displayed as a thumbnail image.

As an example, a school librarian who is working with a teacher on an Arctic mammals project could add an image of an Arctic hare by linking directly to a JPEG image on the Flickr photo sharing site. (CC policy recommends using images that have a Creative Commons license allowing reuse, and adding the creator’s name to the description field for attribution purposes).

**Mix ingredients to create a new learning object.** School librarians that just want to present an image may be satisfied with the Find capabilities. Perhaps they just need a photo of a bird egg to spur discussion related to a unit on animal life cycles or build on a story read to the class. But for those more adventurous adapters and improvisers, the system offers other features to organize resources into a broader context for instruction.
Most digital collections display their contents in a list or sometimes in a static gallery view of thumbnail images or icons, linked to individual resources. Content Clips takes the use of icons and thumbnails one step further. By making a mix, teachers and school librarians can place resources within an interactive visual and gestural interface, and move them around within an interactive presentation space so that the resources can be sorted, reordered, compared or contrasted side-by-side, or even stacked (see figure 4 on the previous page).

Once a new mix is created, it appears in the Mix Zone, ready to accept content, and is also saved in the user’s personal collection. A simple mix might contain only a few clips from either the Clips Collection or My Content, or both. Users can also embellish a mix with a background. Backgrounds support common classroom tasks such as categorizing, matching, and sequencing, and include diagrams, charts, and other graphics. Mixes also benefit from interactive features such as a drawing tool, label maker, and the ability to drag objects around on the background. Within a mix, users can also set a starting arrangement—how the clips are arranged when the mix is first opened. A reset function returns clip icons and thumbnails to their starting positions. In the case of the Arctic mammals, a teacher might create a mix for a class discussion to compare and contrast animal characteristics and adaptations using a video or images of an Arctic wolf and the Arctic hare, a Venn diagram background, and a few text labels (see figure 5).

SERVE the results to students. Clips and mixes can be assigned to a Clip Zone for classroom presentations. The CC gestural interface with its drag-and-drop capabilities makes it ideally suited for electronic whiteboard display. Double-clicking opens an item to a larger view within the same window. Double-clicking again reveals the largest view, which opens in a separate window. In the example of the Arctic mammal mix, students might be asked to name additional characteristics and place them in the correct part of the diagram (see figure 6).

Reactions to Content Clips

One consistent and striking result in surveying teachers about the value of Content Clips has been the level of enthusiasm expressed for strong visuals—particularly the still image clips when projected in front of a class. Teachers valued a clip selection service and were eager to see the collection expanded. While one might assume that children

Figure 5. CC screens showing the making of a Venn mix.

Figure 6. Example of student activity created in CC.
today are inundated with visual examples, clear "voucher specimen" images were a big draw (Mclean and Tessman 2008). One teacher noted:

"Content Clips is an amazing resource that brings the real world into the classroom in an interactive, innovative way. It personalizes the concepts/content that we would like to teach in an exciting way and a way that may be used for the whole class as well as differentiated for individual students when needed.

Previously when I was preparing my students for learning about different species and habitats, I did not have such clear and memorable visuals for them to connect to. This was so much more powerful."

Teachers have also reported using the Content Clips system in varied ways. One assembled a mix of matching sounds and sonographs for a study of sound waves. Another compiled a mix of images showing different types of volcanoes to give students practice in comparing and contrasting the different types. While simple classification activities are popular, a more complex application was observed in one computer lab. Before class, the lab teacher drew a plant cell diagram with Adobe Photoshop, stored it on Flickr, linked to it as a personal clip in her CC account, and placed it in a mix with an animation and links to a website about cell structure. During class, students used the teacher’s mix online to view the clips and add labels to the cell diagram linked in from Flickr.

Several teachers mentioned ways that Content Clips could help them assess students’ knowledge and cognitive skills. A majority was impressed by the system’s power to motivate students and engage them in inquiry learning activities. As one teacher noted, "Once a teacher learns how to compose this, it opens up endless possibilities, and, more importantly, students are excited and learn from this interaction” (Mclean and Tessman 2008).

These reactions to Content Clips offer school librarians many contexts for collaboration and promotion of the skills and dispositions reflected in AASL’s Standards for the 21st-Century Learner related to creating new knowledge and sharing knowledge through a variety of media.

Planned Upgrades

The current grant will enhance the Content Clips project by focusing on features that teachers have most requested. Plans include adding more multimedia clips, offering a mix template for assembling multi-page e-books, and letting users upload their own mix backgrounds.

Other Applications for Content Clips for School Librarians

Beyond Penguins and Polar Bears e-zine. Content Clips contains

Figure 7. Example of an e-book created for an ezine.

Figure 8. STEM Stories homepage.
The current collection focuses on stories of scientists and engineers, role models through the personal stories collection. STEM stories.org. The STEM aim at grades 4–8, <www.stemstories.org>. This free website called STEM Stories, this project has launched a new online multimedia clips and a database of brief text profiles. The clips include image albums, podcasts, and short videos that introduce individuals working in varied STEM careers. Some resources were selected from other collections such as Teachers’ Domain (see Daniella Quinones’s article in this issue). Profiles highlight women working in STEM fields past and present, and include links to other Web resources. Selected present-day women are featured in depth, with personal photo albums, interviews, video field trips, and interactive experiments, which were produced specifically for the project. Subjects include robotics engineer Heather Knight, dolphin communication researcher Diana Reiss, atmospheric chemist Susan Solomon, and astronaut Millie Hughes-Fulford. Future plans include highlighting more engineers and mathematicians, adding a teacher resource tab, and producing new profiles, albums, interviews, experiments, and video field trips.

Telling STEM Stories through Content Clips. The same database framework that CC relies on to deliver and manage content is being applied to power a totally different online collection. Also headed by Rick Tessman and me, this project has launched a new free website called STEM Stories, aimed at grades 4–8, <www.stemstories.org>. The STEM Stories collection highlights STEM careers and introduces strong role models through the personal stories of scientists and engineers. The current collection focuses almost exclusively on women, and contains many resources from an earlier CD-ROM entitled Telling Our Stories: Women in Science. A grant from the NSF’s Research on Gender in Science and Engineering program is making it possible to update and expand the original content and publish it on the Web (NSF HRD-0734004).

STEM Stories offers a searchable collection of multimedia clips and a database of brief text profiles. The clips include image albums, podcasts, and short videos that introduce individuals working in varied STEM careers. Some resources were selected from other collections such as Teachers’ Domain (see Daniella Quinones’s article in this issue). Profiles highlight women working in STEM fields past and present, and include links to other Web resources. Selected present-day women are featured in depth, with personal photo albums, interviews, video field trips, and interactive experiments, which were produced specifically for the project. Subjects include robotics engineer Heather Knight, dolphin communication researcher Diana Reiss, atmospheric chemist Susan Solomon, and astronaut Millie Hughes-Fulford. Future plans include highlighting more engineers and mathematicians, adding a teacher resource tab, and producing new profiles, albums, interviews, experiments, and video field trips.

Several teachers mentioned ways that Content Clips could help them assess students’ knowledge and cognitive skills. A majority was impressed by the system’s power to motivate students and engage them in inquiry learning activities.

Works Cited:

Lois McLean is co-owner of McLean Media, a design and production firm that specializes in creating interactive multimedia programs for schools, educational publishers, and museums. With husband and business partner Rick Tessman, she is co-principal investigator for two recent National Science Foundation projects: Content Clips: A Selection, Customization, and Presentation Service for Elementary Science Education (NSF DUE-0938120) and Telling STEM Stories with Content Clips (NSF HRD-0734004). Before focusing on educational technology, she began her career as an elementary classroom teacher and reading specialist.
USING SOCIAL MEDIA TO BUILD AN ONLINE PROFESSIONAL LEARNING NETWORK OF MIDDLE LEVEL EDUCATORS
Social media tools are providing rich, interactive environments for online users; these tools are causing social and cultural shifts in how users create content, interact with the content on the Web, and collaborate with one another. Thomas March (2007) states that the significance of these digital tools lies not in the technological revolution, but rather in the social revolution that these tools facilitate—such as in the creation of online communities of practice via a social network. These Web 2.0 tools allow users to modify existing content, create new content, personalize their Web experiences, and build online educational networks around shared interests.

Prior to this point, webpages didn’t allow conversations to evolve. Now with digital tools such as wikis and blogs, conversations can occur between people who are viewing the same content. According to Steve Hargadon, “the conversations that used to happen in the hallways or teachers’ lounges or at conferences are now happening all the time on the Web, and the more conversations you can have about your work, the more you can develop your specific professional interest” (Long 2009). This paradigm shift presents new possibilities in terms of creating, delivering, and participating in professional development activities (Hargadon 2009).

The term “social media” refers to the set of new media that enables social interaction between participants, often through the sharing of media. Although all media are in some ways social, the term “social media” came into common usage in 2005 as a term referencing a central component of what is frequently called “Web 2.0” (O’Reilly 2005) or the “social
Web.” These terms refer to the layering of social interaction and online content. Popular genres of social media include instant messaging, blogs, social network sites, and video- and photo-sharing sites. While educators and students are using social media in varying degrees, both personally and professionally, the potential of using such tools to purposefully deliver professional development has barely been tapped (Becta 2008, Luckin et al. 2008, NSF Taskforce on Cyberlearning 2008).

An opportunity to integrate social media and build an “architecture of participation” (O’Reilly 2004) around the existing NSDL Middle School Portal content opened up in 2007 when the National Science Foundation’s National STEM Distributed Learning (NSDL) program solicited grant proposals for “Pathways” projects. While the NSDL Middle School Portal website was well received, project staff began to see it as a launching pad to more integrated, dynamic engagement and professional development, and as a vehicle to help close the “participation gap” of middle grades educators (Ito et al. 2010). A project team from The Ohio State University, National Middle School Association, and Educational Development Center, Inc. collaborated in writing a proposal for the Middle School Portal 2: Mathematics and Science Pathways (MSP2) project <http://msteacher.org>. The proposal was funded (NSF Grant 0840824) in September 2008. As summarized by its tagline, MSP2 “supports middle grades educators with high-quality, standards-based resources, and promotes collaboration and knowledge-sharing among its users.”

The focus of MSP2 is to increase professional collaboration by providing interactive experiences; promoting creation, modification, and sharing of resources; and facilitating collaborative professional development around core concepts in the middle level mathematics and science curriculum and the integration of technology. Putting digital tools together in an environment that encourages community and collaboration creates enormous potential to build a network of colleagues and provide meaningful opportunities for individualized professional growth. MSP2 also leverages other social media networks (Twitter, LearnCentral, MagCloud, Slideshare, and Issuu) to communicate with users and extend the community.

Tools for Building an Online Professional Network

Ning

The MSP2 project staff chose Ning as its resource portal and social media platform for a variety of reasons. Ning is an online service that allows users to create their own social networks with the flexibility of determining the site’s appearance and functionality, and whether the site is public or private. Ning supports photos and videos, lists of network members and events, groups within the network, and communication tools such as forums and blogs. The MSP2 social network was launched in February 2009 and (as of August 23, 2010) had 1,077 registered members with more than 51,000 visitors in the last year. The MSP2 social network is open (all content is viewable by anyone), but if users wish to participate in a conversation (i.e., a blog or forum discussion) or add an event, they must register with the site.

Project staff have experimented with the layout of the main MSP2 page since its initial launch. Feedback such as metrics data, user comments, and help from other Ning community builders informed our decisions. The August 2010 iteration (figure 1) of the MSP2 homepage includes access to:

![MSP2 homepage, August 2010.](image-url)
• MSP2 resources, such as MSP2 Math and Science Resource Guides, Teacher and Student Opportunities pages, a Webinar Archive, Getting Grants resources, Cool Tools sources, and the Search MSP2 Collection feature

• links to information about online events

• “Latest Activity” links

• forums

• information for members and the Quick Poll feature

• blogs that are fed into the Main page via RSS—MSP2 Connecting News to the National Science Education Standards, MSP2 Exemplary Resources for Middle School Math and Science, Free Technology for Teachers, the NSDL Engineering Pathway blog, and the New York Times Science and Technology news feed.

All members of the MSP2 site are individually welcomed by project staff upon registering and are oriented to the site’s key features.

Members can also participate in active discussions on a variety of topics, including strategies for teaching STEM through service learning, integrating Web 2.0 and other technology tools into practice, science and mathematics fairs, Citizen Science project ideas, issues related to laboratory safety, and ideas for connecting classroom content to “the real world” and to current events (e.g., the Gulf oil spill, safe recycling practices, pollution, and other environmental issues). Special interest groups are encouraged through the Ning's Group feature. Currently these groups include Teacher Education, Working with English Language Learners, Integrating Technology, and Literacy in the Content Areas. These affinity groups provide an online space to share ideas, strategies, successes, and challenges. Project staff also host a periodic Book Club group where participants meet online to discuss a particular book choice, as in face-to-face book clubs.

**Wikis**

Using a wiki for content delivery allows visitors to add their own resources, suggestions, and experiences—a feature that allows the content to continually evolve into a richer product. From a content developer position, using the wiki format allows content to be published to the Web instantly with little to no Web development costs. MSP2 has its own Web space within the NSDL Wiki, with an MSP2 skin and development work done on behind-the-scenes pages. Once a page such as a resource guide is ready to be launched, it is placed in the appropriate area of the MSP2 wiki. All MSP2 Math and Science Resource Guides (figure 2/3) are editable wiki pages, as is the information on specific opportunities for both teachers and students (e.g., grants, fellowships, teacher and student awards, mathematics/science student camps). Users are encouraged to add to and enhance these pages.
In addition to embedding images within the text, the MSP2 science wiki pages include NSDL Science Literacy Maps and RSS feeds from appropriate New York Times science topics. The NSDL Science Literacy Maps based on the strand maps developed by Project 2061 at the American Association for the Advancement of Science and published in the Atlas of Science Literacy Volumes 1 and 2 help teachers understand the connections between concepts and how concepts build upon one another across grade levels. These clickable maps highlight “Top Picks”—resources that relate to each science concept—and related National Science Education Standards. Many of the “Top Picks” come directly from the MSP2 Digital Library of Curriculum Resources. Embedding the RSS feeds from the New York Times science topics into the appropriate wiki pages provides up-to-date information on the latest news and research. For example, the Plate Tectonics: Moving Middle School Science resource guide includes one strand map and two New York Times science topic RSS feeds.

**Elluminate Webinars**

MSP2 offers both synchronous and asynchronous opportunities to support the learning community and its members. MSP2 hosts a number of live webinars throughout the year on various mathematics, science, and technology topics. Some examples of MSP2 webinar topics include “Interactive Notebook and Interactive Whiteboards,” “Moodle for Middle School,” “Wikis for the Classroom,” “Digital Tools and Math,” “Universal Design for Learning,” and “STEM Career Resources.” Every MSP2-hosted webinar is recorded and archived on the MSP2 wiki site. The project also routinely highlights webinars that are conducted by other organizations on topics of interest to the MSP2 community, such as events from the NSTA Learning Center, National Girls Collaborative Project, National STEM Digital Library, and Classroom 2.0.

**What Have We Learned So Far?**

Over half of MSP2 members have eleven or more years of teaching experience. In fact, according to the Profile Questions Survey, of the 505 respondents, 40 percent (200) had fifteen or more years of classroom teaching experience, and another 18 percent (90) had eleven to fifteen years of experience. Members with five or fewer years comprised 21 percent of the community. Members either have curiosity about or some comfort with social media. They are interested in exploring and integrating digital tools in their classrooms, and are overwhelmingly eager for insight and guidance on how best to employ those tools.

MSP2 members are more interested in engaging with each other around use of digital tools and literacy across the content areas than they are about mathematics and science content or pedagogy. Yet they access the mathematics and science resources for their teaching needs. In other words, mathematics and science content and resources draw teachers into the site, but their active participation is encouraged by the conversation and opportunities to extend learning around integrating technology and digital tools. One would expect a more experienced teacher to be confident in her or his content and pedagogy and feel little need for direct support in those areas, but these digital immigrants may be more in need of support in integrating digital tools.

Members do not, on a large scale, modify the site’s content. Members make only a few edits on wiki pages. Members do not add events, even though they are encouraged to do so, and the process is easy. Only a small percentage of the members outside of project staff have blogged or initiated discussions. In retrospect, this should not be a surprise. After all, in 2006, five years after its
inception, Wikipedia had only about 1,000 core members doing the vast majority of edits on its millions of pages (Hafner 2006).

Members have not assumed active facilitation of the site. Were it not for project staff and for teacher leaders’ posting, adding content, or responding to discussions, there would be little overt activity. We are beginning to think that there must be a “tipping point” —a level of user activity at which the community begins to assume responsibility. How many registered members are required? The number of visitors to the site has increased, but how do we encourage these visitors to become registered members and actively participate in sharing and creating content?

Conclusion
According to the MSP2 evaluation report for Year 2 (Woodruff, Morio, and Li 2010), people have refrained from overt participation because they were afraid of “sounding unprofessional,” lacked technical expertise, and had “grave concerns about personal privacy and Big Brother.” While emphasizing that resources might be able to mitigate these fears, it might be important to diffuse these fears by directly addressing them in webinars or information pages on the site. In addition, time was indicated most often as the reason for not participating actively on the MSP2 Ning and for not participating in online social networking in general. Time will always be a challenge for educators; perhaps the response to this is to present MSP2 as a time-saver as the portal provides such things as direct access to vetted Web resources, lesson plan ideas, and access to other classroom teachers, school librarians, and content area experts. Users say that they have little to no previous experience with online social networking, and perhaps this lack of experience impedes their activity and confidence. Or perhaps the emphasis on the social networking, collaborating, and connecting aspects of the site scares users off. Maybe we need to stress the digital library aspect of the MSP2. After all, it does appear that the resources are already the hook that draws people in.

Works Cited:


NSDL
AS A TEACHER EMPOWER POINT

Expanding Capacity for Classroom Integration of Digital Resources

by: Eileen McIlvain | eileen@ucar.edu

This material is based upon work supported by the National Science Foundation under Grant 0840858: NSDL Center for Sustaining Broader Impacts, and No. 0840744: NSDL Technical Network Services: A Cyberinfrastructure Platform for STEM Education. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.
The National STEM Digital Library (NSDL) program was established in 2000 by the National Science Foundation (NSF) as an online library of exemplary digital resources for science, technology, engineering, and mathematics (STEM) education and research at all educational levels (NSF 2010). NSDL (http://nsdl.org) is a multi-institutional collaborative using digital technologies for the delivery of high-quality Web-based STEM education materials and services in multiple settings.

**Linking Communities of Practice**

Simultaneously (but perhaps less visibly to the end user), in addition to being a valuable resource collection, NSDL is also a large, multifaceted national network of communities of practice—comprised of disciplinary faculty, pre-service and in-service K–12 teachers, professional development experts, educational technologists, informal educators, and evaluators. This network represents a social infrastructure for collaboration that preceded technology-based online social networks. This collective experience as a distributed digital education network is the glue connecting a creative community of both providers and users dedicated to advancing education using 21st-century Web-based capabilities. The NSDL builds on its technological infrastructure, partner innovations, and emerging technologies that incorporate effective use of socially based, untethered, digitally rich learning (Project Tomorrow 2010) to provide services and professional development that empower educators to confidently integrate digital resources and technologies in their practice and classrooms. NSDL acknowledges the current relevancy of self-directed learning, with its characteristic values for experiential learning, personalization, customization, and connection-making.

NSDL has witnessed and collectively adapted to a variety of educational trends and sea changes—in technology use, social practice, technological and pedagogical content knowledge acquisition and expertise, adaptations of technology to educator professional development, understanding of the way people learn, and evolving expertise about the free-agent learner—enabling NSDL to serve as a vital partner in NSF’s strategy for the development of integrated cyberlearning approaches for STEM education (NSF 2008).

Early in NSDL’s lifecycle, providing access to digitally based materials was the goal, and NSDL’s scope and intended audience was all-encompassing (although primarily focused on serving the needs of educators). Like many digital libraries, NSDL holds descriptive information (metadata) about the 130,000+ resources in its overall collection, and it provides a free and organized point of access to these resources and to its partner discipline- and audience-focused digital library portals (NSDL Pathways). Via this descriptive information NSDL points users to exemplary Web-based resources (lesson plans, activities, audio and video files, images, interactives), and the content NSDL refers to is owned and maintained by its providers and contributors. But access alone does not translate to effective teaching or learning, and NSDL is far more than a static repository of digital content.

---

1 NSF’s National STEM Education Distributed Learning program resides in the Education and Human Resources Directorate (EHR), Division of Undergraduate Education (DUE).

---

**NSDL.ORG WEBSITE**

Use of the NSDL.org website and related search and reference services is free, as are the majority of the resources discoverable through NSDL. Use of NSDL.org does not require account creation. NSDL does, however, require account creation and login for related services, such as the Expert Voices blogs and NSDL’s Community site—supporting information and collaborative needs of its NSF-funded projects and other partners <http://nsdlnetwork.org>.

Some resource providers who make their materials accessible through NSDL require user account setup and login on their own portals to support personalization services for their users (e.g., foldering systems or alert/notification systems) and to enable anonymous data gathering about use of their sites and services. Some providers also restrict access or apply fees to purchase selected resources or collections because they are subscription-based services or components of professional society membership services.
“Digital libraries need to distinguish themselves from Web search engines in the manner that they add value to Web resources. This added value consists of establishing context around those resources, enriching them with new information and relationships that express the usage patterns and knowledge of the library community. The digital library then becomes a context for information collaboration and accumulation—much more than just a place to find information and access it…”

(Lagoze et al. 2005).

**The Cs Have it: Content, Community, Context, Capacity**

In a world where a host of popular online search engines can return millions of results for most common keyword searches, digital libraries provide more efficient exploration and filtering over sets of focused resources, usually selected through vetting and review processes with criteria designed to meet the needs of specific audiences. NSDL accomplishes these filtering and curation functions through its multiple Pathways and services projects, and via the activities of an NSDL Accessioning Board that reviews sample resources from collections for adherence to the NSDL Collection Policy (NSDL 2010a) and Guidelines for Resource Quality (NSDL 2010b), advises collection builders of recommendations for change, and approves collections for accessioning into NSDL.

NSDL Pathways are discipline-specific (biology, chemistry, climate science and literacy, computational science, computing sciences, earth sciences, engineering, materials science, mathematics, physics and astronomy, social sciences/quantitative literacy) or education-level-specific (middle school, K–12 multimedia, community and technical colleges, informal education) partnerships that provide stewardship for the educational content and services needed by major communities of learners. Pathways contribute in-depth knowledge about the educational needs of their audiences and are a primary means by which NSDL creates important connections between the scientific research community and the classroom. Seventeen Pathways—each its own specialized digital library—support K–12, higher education and community colleges, and informal learning.

NSDL Pathways provide a range of services supporting and adapting to the needs of their communities of use, such as creation of topical and contextualized collections, and exploration and use of multiple delivery channels designed to more efficiently reach user and practitioner communities. Contextualized collections enable, for example, a teacher to access discussion questions related to a particular video clip, use follow-up activities, or view educational standards related to the resources they discover (as in the collections of Teachers’ Domain, Engineering Pathway, ComPADRE, DLESE). Undergraduate students can increase their selection skills about virtual lab simulations when they can see alignments to the most frequently used college textbooks (ChemEd DL), or use specialized collaborative wiki environments for their own research activities and developing research practice (Materials Digital Library).

Understanding the scientific process and scientific findings becomes real to middle school students when they can read the journal entries from scientists on research expeditions (Beyond Penguins and Polar Bears; see Jessica Fries-Gaither’s article in this issue). Teachers can gain content background knowledge, use bundled resource sets and activities, and access additional suggested readings to teach specific topical units (Middle School Pathways; see Kimberly Lightle’s article in this issue). A full list of Pathways appears at <http://nsdl.org/about/?pager=pathways>.

**Hot off the Virtual Presses: Common Core Math Collection**

NSDL is currently building a contextualized demonstrator collection of resources related to the recently released Mathematics Common Core standards, the state-led effort designed to provide a shared set of consistent standards for student learning in key domains. With support from the National Science Foundation, NSDL is collaborating with the Applied Math and Science Education Repository (AMSER) Pathway <http://amser.org> and Internet Scout <http://scout.wisc.edu> projects at the University of Wisconsin and the American Association for the Advancement of Science’s (AAAS) Project 2061 to assemble and catalog this special collection. NSDL has gained invaluable insight adding to the knowledge base about effective association between educational resources and standards, and the complexities, granularities, and reliability involved in such relationship-making.
In a world where a host of popular online search engines can return millions of results for most common keyword searches, digital libraries provide more efficient exploration and filtering over sets of focused resources, usually selected through vetting and review processes with criteria designed to meet the needs of specific audiences.

The NSDL Common Core Math collection <http://nsdl.org/browse/commcore/math> provides easy access to high-quality math resources that have been related to one or more standard statements within the Mathematics Common Core Resources. These resources are selected from the NSDL collection and trusted providers, and organized by grade level and domain area. Resource types may include assessment material, answer keys, rubrics, tests, datasets, instructional materials, activities, demonstrations, games, instructor guides or manuals, lesson plans, problem sets, instructional units, numerical models, and more. See the “NSDL Math Common Core Collection Examples” sidebar for example resources.

### NSDL Math Common Core Collection Examples

**Scaling the Pyramids**—virtual tour
[www.pbs.org/wgbh/nova/pyramid/geometry/index.html]

This website features activities that compare the Great Pyramid to such modern structures as the Statue of Liberty and the Eiffel Tower. In the first activity, students use a template to construct a scale model of the Great Pyramid. They must find the scale height for the tallest building in their neighborhood or for their own height. In the remaining activity, students are given the dimensions for two other pyramids and challenged to create models.

STANDARDS: 7.G.1
GRADE LEVEL: Grade 6–10; High School; Middle School

**Linear Equations**—tutorial with practice and assessment
[http://lgl.skool.co.uk/content/keystage3/maths/pic/learningsteps/LIELC/LO_Template.swf]

This narrated demonstration introduces students to linear equations with one variable, their visual representation, and how to solve them. After the clear instructions, to test what they’ve learned, students solve two equations on their own. The lesson concludes with a review of the objective and summary of the key points.

STANDARDS: 8.EE.7.a / 8.EE.7.b
GRADE LEVEL: Grade 6; Middle School

**Proportional Reasoning**—uses AV to support teachers’ instructional approaches
[www.learner.org/courses/learningmath/algebra/session4]

In this session, a special kind of functional relationship is explored: the proportional relationship. Students develop proportional reasoning skills by comparing quantities, looking at the relative ways numbers change, and thinking about proportional relationships in linear functions. This lesson has four objectives. Students learn to: differentiate between relative and absolute meanings of “more” and determine which of these is a proportional relationship, compare ratios without using common denominator algorithms, differentiate between additive and multiplicative processes and their effects on scale and proportionality, and interpret graphs that represent proportional relationships or direct variation.

GRADE LEVEL: Grade 8; Middle School

**Make Your Own Fractions Worksheet**—teachers’ resource
[www.theteacherscorner.net/printable-worksheets/make-your-own/math-worksheets/basic-math/fractions-equations.php]

From The Teacher’s Corner, this resource allows educators to quickly make worksheets for students to practice addition, subtraction, multiplication, and division of fractions. Teachers can specify one or more fraction operations, the title, instructions, number of problems, ranges of numerators and denominators, and much more. Worksheets are automatically generated in printable form, and the answer key is on the second page, if desired. Teachers are also encouraged to offer feedback at the bottom of the page.

STANDARDS: 4.NF.3.a / 4.NF.3.c / 5.NF.1 / 5.NF.4.a
GRADE LEVEL: Elementary School; Grade 4; Grade 5; Upper Elementary
Educational Platform Services
NSDL’s technological and social infrastructures and partnership-building strategies leverage its collective educational technology expertise through the provision of platform services that enable groups or organizations (school districts, science centers, colleges and universities, consortia, and other partnerships) to use NSDL technology solutions and tools in ways that can systemically and programmatically affect reach and adoption across practitioner communities. Clients can build their own collections and digital libraries, adapting existing NSDL infrastructure and services to the varying needs of their own information frameworks and state or district portals and tools. Clients can also install NSDL search capabilities within their own portals and leverage a variety of dissemination channels that capitalize on use (and reuse) of STEM content. NSDL platforms enable participation in broader national collaborations that seek to capitalize on future-facing new media practices.

NSDL services include:

- **EduPak**—an open source suite of collection and digital library building tools (a cataloging and collection management system, search service, and metadata harvester)

- **Collection Workflow Integration System (CWIS)**—a turnkey software package built and maintained by Internet Scout projects, University of Wisconsin, enabling assembly, organization, and sharing of digital collections with NSDL, and others

- **NSDL Strand Map Service**—a Web-service protocol supporting construction of interactive knowledge map / conceptual graphical interfaces, based on the learning goals articulated in the American Association for the Advancement of Science Benchmarks for Science Literacy; one such interface example is the NSDL Science Literacy Maps <http://strandmaps.nsdl.org/>

- **Curriculum Customization Service (CCS)**—a customization tool supporting purposeful planning by teachers around learning goals, and supporting curricular components, interactive digital resources tied to learning goals, and/or related state and national standards within a personal customizable workflow workspace (Sumner and CCS Team 2010)

- **Content Alignment Tool (CAT)**—assists collection providers, catalogers, and teachers in assigning educational content standards by providing suggestions of relevant standards developed at the Center for Natural Language Processing (CNLP) at Syracuse University

- **NSDL Expert Voices (EV)**—a MediaWiki-based blogging system supporting online conversations among scientists, teachers, and students. Blog posts can be related to NSDL resources and contributed back to the library, providing additional context for digital resources. EV blogs can be redistributed via RSS feed capability to enable posting in other venues, websites, or communications channels

More information on NSDL services is available at <http://nsdl.org/contribute/?pager=developers>. Organizations interested in using NSDL technology solutions or partnering with NSDL may use the Contact Us form at <http:// nsdl.org/about/contactus>.

Professional Stress? Tapping the Network for Professional Development
As the information and communications technology (ICT) environment has exploded and 24/7 ubiquitous computing is the norm, there is a corresponding amplification in the need for skills development, tools, and expert services for information management and efficiency in selecting, integrating, and utilizing digital resources in classroom and other settings. K–12 teachers, especially, are expanding their own 21st-century skill sets, while expected and encouraged (or mandated) to integrate and impart these same 21st-century proficiencies to their students. And while educators at all levels are advancing these skills, they are simultaneously confronting the need for familiarization with and observation of best practices for intellectual property and copyright compliance; social networking use and incorporation; adherence to curriculum demands and standards alignment; and practices and policies generated by schools, districts, states, universities, federal agencies, and Congress.
Teachers face a dizzying array of requirements, expectations, and needs—from school administrators, districts, states, parents, and students—as well as their own desires for maximizing expert and peer knowledge. Librarians play a vital role in leveraging, filtering, and imparting to teachers information about effective use of digitally based information, communications, and content resources, and in identifying needs that remain unmet. Using the NSDL network of resources and services as an “empower point” for educators, librarians can help to build capacity-building proficiencies. As these educator proficiencies develop in the use of technology innovations, a progressive (though not necessarily linear) shift in competencies emerges: educators transition from face-to-face workshop attendees to practiced online webinar participants; from online website users to online contributors or bloggers; from educators to digital resource creators and teacher-leaders.

Among systemic impediments to achieving effective teaching and demonstrating positive student learning, the not surprising “elephant in the room” is the real-world devaluation of the teaching professions that is made even more evident by stressful economic conditions. The good news / bad news juxtaposition is that the top twenty best-paying college degrees leading to high salaries all involve high-level math and are dominated by engineering fields (O’Shaughnessy 2010b). On the other hand, the worst-
Neither NSDL nor individual educators can provide fixes to this situation in the near-term, but we can work systemically to afford our educators at all levels the professional recognition they have earned. We can provide supports for professional (and personal) growth through the provision of systems, social professional networks, collaborative opportunities, and effective professional development that offers authentic engagement and instruction in educational technologies, pedagogical supports, and needs for just-in-time content knowledge.

Given the sobering realities, it is especially important to extend proficiency-building professional development and best practices into the pre-service arena—colleges of education and other teacher-educator programs. NSDL is strengthening existing partnerships and building new alliances to projects and programs such as the National Science Foundation’s Noyce Scholars Program <www.nsf.gov/funding/pgm_summ.jsp?pims_id=5733&org=DUE&from=home> to support pre-service and career-changing in-service teachers. NSDL is developing a complement of NSDL online webinars for the 2010–2011 academic year, focusing on the how-to’s of digital resource integration in classroom teaching and building a body of information for best practices across multiple aspects of educational technology use (e.g., RSS feed use, social networks, metrics, and evaluation) with collaboration from NSDL Pathways, services projects, and other partners. Pathways digital libraries also provide a range of professional development opportunities including online webinars, disciplinary
and technology-in-education conference workshops, and an array of subscribable newsletters.

Current NSDL tools and services supporting professional development include the following.

- **Science Refreshers service** [http://nsdl.org/refreshers](http://nsdl.org/refreshers) supports elementary educators with resources selected from among NSDL collections that are best suited to help teachers brush up on their science content knowledge as they are preparing their classroom lessons.

- **NSDL Science Literacy Maps** [http://strandmaps.nsdl.org](http://strandmaps.nsdl.org) help K–12 teachers find NSDL resources for specific science and math concepts, while reinforcing their own conceptual frameworks. These maps, based on the American Association for the Advancement of Science Project 2061’s Atlas of Science Literacy, illustrate connections between concepts as well as how concepts build upon one another across grade levels.

- **Expert Voices** [http://expertvoices.nsdl.org](http://expertvoices.nsdl.org) is a blogging environment supporting online conversations among scientists, teachers, students, and others. EV blogs can be used within a community of educators to address educational issues and/or topical instruction, while advancing blogging skills of contributors. These blogs have been used as an undergraduate curriculum component within a specific course where students blog as part of their course requirement, or as an outreach/dissemination mechanism targeted to specific user groups.

- **NSDL–NSTA Web Seminars** [http://nsdl.org/resources_for/k12_teachers/pd-archive.php](http://nsdl.org/resources_for/k12_teachers/pd-archive.php) are joint projects with the National Science Teachers Association. NSDL has partnered over the last four years with NSTA to produce webinars on STEM topics using Web-based tools and services available via NSDL projects. Recorded webinars are available from NSDL.org or NSTA’s Learning Center [http://learningcenter.nsta.org/products/web_seminar_archive_sponsor.aspx](http://learningcenter.nsta.org/products/web_seminar_archive_sponsor.aspx).

- **NSDL Brown Bag Web Seminars** [http://nsdl.org/pd/?pager=brownbag](http://nsdl.org/pd/?pager=brownbag) feature topics of interest to the community of NSDL projects and educators. Webinars may be focused on community discussion of issues in educational technology use, or on best practices in the use of digital resources, collections, and services/tools.

- **NSDL on iTunes U** [http://nsdl.org/iTunesU](http://nsdl.org/iTunesU) offers multimedia resources for science and math education, including videos, podcasts, and educator guides that augment content knowledge and can be incorporated in the classroom.

Additional areas for professional development and collective understanding that NSDL is highlighting include:

- effective ways to highlight and feature interdisciplinary content and service development of collections that are more student-centered;
- exploration and understanding of educational uses of mobile technologies;
- development of guidelines, best practices, and resources supporting evaluation; and
- pursuit of both programmatic and socially based methods for really getting at that elusive beast: impact on student learning.

Teachers, faculty, librarians, administrators, and students are vital participants in NSDL efforts to understand the “what and how” of digital resource use in multiple practitioner communities, and how that use translates to effective learning. More information on professional development activities can be found at [http://nsdl.org/pd](http://nsdl.org/pd).

### Initiatives: Learning Registry and STEM Exchange

Educational dating services? Not exactly. The Learning Registry is a multi-agency initiative designed to improve discoverability of federally funded educational content. It, too, is leveraging existing and emerging technologies so that multiple search engines can expose learning resources with the intent that this networked environment will enable usage in multiple applications, open educational resource collections, mobile applications, and online learning environments and digital libraries. NSDL is partnering in these national discussions, representing both the needs of STEM resource providers and STEM educators and learners to inform Registry development. More information is available via the Learning Registry site at [http://www.ed.gov/blog/2010/07/the-learning-registry-a-first-look-2](http://www.ed.gov/blog/2010/07/the-learning-registry-a-first-look-2). You can also follow NSDL participation in the effort via NSDL’s Community site at [http://nsdlnetwork.org/learningregistry](http://nsdlnetwork.org/learningregistry).
The STEM Exchange is a new strategy and initiative led by NSDL in response to the educational changes made possible within our increasingly connected and networked world. The focus of the STEM Exchange is to more fully gain data and understanding about the impact of use of cyberlearning resources for STEM education. By improving communications and feedback loops across educational communities of practice—who test out what works in real-world learning environments—and between these educational user-practitioners and resource developers and providers, the effort seeks to capture, share across networks and back to creators and providers, and enable networked use of data about digital resource use to improve STEM education efforts.

The vision of the STEM Exchange calls for a new information system around digital resources that can automatically capture and display aggregated real-time user interaction data. Resources are annotated, reviewed, downloaded, embedded, shared, accreted, modified, and updated by user-practitioners through their professional online communities, social media spaces, and state and district resource portals. STEM Exchange is being built by NSDL, in collaboration with a range of STEM education partners, as an open source Web service designed to:

1. speed the diffusion of digital content to educational practitioners through a wider range of online dissemination channels and mobile devices;

2. promote the relating of digital learning content to academic achievement standards, including the emerging Common Core Standards;

3. empower existing teacher communities to mobilize contextualized materials directly in their own online platforms; and

4. enable broad user feedback data to enhance understanding about the adoption and impact of cyberlearning resources in diverse teaching and learning environments.

Through the Exchange, online communities of educational practitioners will be able to directly integrate customizable datastreams about resources from NSDL and other providers into their user platforms. The social media activities of practitioner communities will generate data about how resources are being used in different contexts that the STEM Exchange will assemble into resource profiles, incorporating both handcrafted and automatically captured information. The resulting *paradata* describing resource use will be fed back into resource profiles to assist users in discovering and utilizing educational materials, and to enhance resource providers’ understanding of how their materials are being disseminated, used, and contextualized by practitioners. More information on the STEM Exchange initiative can be found on the NSDL Community site at <http://nsdlnetwork.org/stemexchange>.

**Expanding Common Core Collections**

NSDL continues to expand its work in this area, further developing Common Core collections with additional resources and contextualized content from its partnerships, both within and without NSDL, and extending collection building for both the Math and the anticipated Next Generation Science standards, as they are released in 2011 (<www7.nationalacademies.org/bose/Standards_Framework_Homepage.html>).

**Looking Forward to the Next Ten Years**

Throughout its lifecycle, NSDL has reviewed its activities through lenses focused on the needs of its communities of users, as well as on the scope, scalability, and sustainability of its technological and social infrastructures. These lenses—continually refocused by community input—have helped us “ground-truth” our knowledge and assumptions, and provide reality checks on our efforts. Over time, NSDL has experienced both major and minor transitions (in technological infrastructure, services provision, community and collaborative structures, and practices), yet the overarching principles that NSDL reaffirms each year when developing its work plans and priorities, and
conducting its annual meetings and ongoing community engagement, ultimately circle around to the needs of educational end-users. Focus remains on:

- maintaining and operating the technical and social infrastructures of NSDL, and increasing the breadth and depth of platform usage and collaborative expertise;
- enhancing user experience, placing the library and its services in the path of users, and staying responsive to changing needs and realities;
- developing user capacities to effectively integrate cyberlearning resources in educational settings;
- enabling both expert and user contextualization of resources based on practitioner on-the-ground needs;
- exploring, developing, and capitalizing on best practices for evaluation and analysis;
- marshalling the strengths of the NSDL community and expanding strategic partnerships to best leverage time, talent, and treasure; and
- evolving NSDL’s value as a content provider to practitioner networks and educational systems’ portals.

In these ways, NSDL continues to refine its role as a national network of creative educators, developers, and providers dedicated to advancing STEM teaching and learning, and as a leader and partner in strategic educational technology application.

---

Eileen McIlvain is communications manager at the National Science Digital Library (NSDL) Resource Center. She is also a liaison to NSDL’s Pathways projects (serving unique STEM communities of users), is the NSDL websites editor, and contributes to NSDL outreach activities. Her interests lie in understanding effective uses and integration of technology in education.

---

**Works Cited:**


---

Educational dating services? Not exactly. The Learning Registry is a multi-agency initiative designed to improve discoverability of federally funded educational content.
MAKING SCIENCE LEARNING AVAILABLE & ACCESSIBLE TO ALL LEARNERS:

LEVERAGING DIGITAL LIBRARY RESOURCES

Anne Marie Perrault
amp33@buffalo.edu
Mort Stein, Ed.D., a science teacher for more than thirty years and a current professor of inclusive science education, is a strong proponent of librarians and science classroom teachers working together to support the learning of students with disabilities. He, and a number of science and special education teachers I spoke with, view school librarians as the ultimate “go-to people.” They consider librarians as ideal partners in helping them find resources and materials that make science learning accessible and available for all students, and also value school librarians as fellow advocates for students with special needs. Stein states, “The library and the librarians are some of the most important resources in the school. I say that not only as a former science teacher, but as a member of the Board of Education” (Stein 2010).

Stein is appreciative, for example, of librarians’ key role in locating science curriculum content in alternative formats and reading levels. He notes that their access to resources can be a big help in creating hands-on science activities that students at all levels can work on in the library. These activities go a long way in fostering an excitement about learning science and in making it accessible to students with disabilities.

When school librarians offer materials and information in a range of formats, students can access and use information that previously may have been unavailable to them. An increasing number of school librarians are discovering that, for many students with disabilities, the multi-modal resources offered by digital libraries are just what they need to break down barriers and facilitate learning.

The availability of a wide range of curriculum resources and formats is one of the key advantages of using educational digital libraries to support science learning. For example, are you working with a science class coming to the library looking for information on weather? Are there students in the class with hearing impairments for whom a close-captioned video on hurricanes would be appropriate? Could you use a podcast featuring scientists discussing climate and ocean currents as an alternative to a print article for a student with a learning disability? A digital library offers an organized collection of resources in a variety of formats and reading levels that relate to specific topics. The resources may be offered in audio, video, digital, print, or interactive formats. In short, a digital library contains almost limitless resources to use in adapting science activities for students with special needs.

Science for All!

The number of students with disabilities is growing. More than 5.7 million students between the ages of three through twenty-one years of age are served in federally supported programs for the disabled. This represents about 12 percent of the school-aged population, a figure that

“All human beings are born with unique gifts. The healthy functioning of our community depends on its capacity to develop each gift.”—Peter Senge (2000, 42)
Special education legislation such as IDEA emphasizes the placement of students with disabilities in the general education classroom. In an inclusive or blended classroom, students with special needs spend most or all of their time with their nondisabled peers, and these students with physical, cognitive, and emotional disabilities often learn science from classroom teachers rather than in separate special education classes. Most of these students are required to pass the same standardized science tests as the children without disabilities, although particular challenges associated with their disabilities may influence their science learning. In some situations, an inclusion teacher will work alongside the classroom teacher to provide individualized support to students with a disability.

To keep up with this changing educational landscape, a growing number of teachers have dual certification. Teachers are entering the field of education with elementary or secondary certification, as well as literacy and/or special education certification. While these teachers may be well prepared academically, challenges in finding instructional materials may still exist. As Mort Stein notes, “Although many teachers are prepared to work with students with special needs and are able to differentiate instruction, the teachers may not have all of the academic resources needed to present a program that will meet the needs of all students” (Stein 2010).

Additionally, the acquisition of materials for classroom use is often dictated by the financial constraints under which districts and individual schools operate.

These gaps in the availability of instructional resources offer opportunities for a meaningful partnership between the school librarian and the science teacher. Science teachers need access to a variety of current and reliable resources to integrate them into teaching and learning practices, thereby creating authentic learning experiences. Gwynne Mosch, a school librarian in a large urban New York high school, exemplifies how a partnership with teachers can succeed. For example, she regularly strikes up conversations with classroom and inclusion teachers to learn more about how to best help students with disabilities. She brainstorms with these teachers on instructional strategies and how different resources might be modified to meet the learning needs of students.
Mosch’s collaboration efforts with science teachers go a long way toward making science available to all students in her school. The philosophy that “science is for all students” is a guiding principal of in the National Science Education Standards (NRC 1996, 2):

“This principle is one of equity and excellence. Science in our schools must be for all students: All students, regardless of age, sex, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science, should have the opportunity to attain high levels of scientific literacy.

Learning science is something students do, not something that is done to them. In learning science, students describe objects and events, ask questions, acquire knowledge, construct explanations of natural phenomena, test those explanations in many different ways, and communicate their ideas to others (NRC 1996, 1).

In several research studies, science teachers shared their frequent frustration when seeking out the resources and materials they need to adapt and modify science activities to support the needs of a variety of students (Hanson and Carlson 2005, Hoffman and Mardis 2008, Perrault 2007). The science teachers try to find a range of resources—visual, auditory, and interactive—to use in their instructional planning and teaching; however, many are stymied by where to start to find science materials and what alternatives to generic search engines are available. By creating the sustained scientific inquiry environments called for in the Science Education Standards, teachers and librarians must know how and where to steer students with disabilities, and this need often means going beyond the textbooks and using digital libraries.

**Highlights of Digital Libraries**

The National Science Digital Library (NSDL) Program offers a great starting point for you and your science teachers to locate science curriculum resources in a variety of formats (see Eileen McIvain’s article in this issue). NSDL is a free online library that directs users to exemplary resources for science, technology, engineering, and mathematics (STEM) education and research. Resources available through NSDL at <www.nsdl.org> include images, video, audio, animations, interactive resources, visualizations, software, datasets, and text documents such as lessons plans. NSDL also offers a number of well-defined search, browse, and help tools.

If you are seeking high-quality science videos for a student with a visual or hearing impairment, The Teachers’ Domain site <www.teachersdomain.org> offers an extensive collection (see Daniella Quinones’s article in this issue). The collection features media from NOVA, Frontline, Design Squad, American Experience, and other public broadcasting and content partners. The earth and space science, life science, and physical science resources are easy to use and correlate to state and national science standards. The significant number of audio, video, Flash interactive resources, images, and lesson plans in this digital library can help school librarians to provide rich science learning experiences to students with a variety of disabilities.

Several of the school librarians I interviewed spoke of wanting to connect with other librarians to discuss how best to support students with disabilities in their libraries. The Middle School Portal 2: Math and Science Pathways (MSP2) offers such a space for networking and collaboration. In addition to instructional support and curriculum resources, social networking and digital tools are available to facilitate professional development and the collaborative creation and sharing of resources. This portal <http://msteacher.org> is run by the Ohio State University, National Middle School Association, and Educational Development Center, Inc. (see Kimberly Lightle’s article in this issue).

Students with learning disabilities may struggle to express ideas in writing or to organize what they want to communicate (National Dissemination Center for Children with Disabilities 2004). Instead of a written science research project, would alternative assessments fit the need for a student with a learning disability? Sara Kajder’s work with reluctant readers and digital storytelling points to improvement in reading comprehension and motivation (2004, 2006). Consider using media production as a means for students to show evidence of knowledge and understanding. Content Clips <www.contentclips.com> offers access to a free multimedia collection along with a tool for organizing and producing presentations (see Lois McLean’s article in this issue). Students also have the option of importing their own images or content from other sites. The complex nature of multi-modal projects often requires collaboration among students with a variety of skill levels (NCTE 2008). Activities combining engagement in critical thinking, science learning, and media literacy offer opportunities for students of all abilities to work together and experience success. School librarians can use the resources in digital libraries to make this possible for students.
Conclusion
Laureen Summers is a program associate with the Project on Science, Technology and Disability at the American Association for the Advancement of Science. She believes it is vital that school librarians reach out to science teachers and create an awareness that school librarians are willing to put in the time and effort to help with adaptations and modifications to make the curriculum available and accessible to all students. Summers notes the occasional attitude in schools that science is too hard for students with disabilities. Librarians can help dispel that notion, and they can play a pivotal role in fostering and sharing excitement about science with students—disabled or not. She encourages everyone to share and promote science materials and reminds us “to be excited! It will bounce from you to the students—disabled or not—and they will respond to your excitement and curiosity” (Summers 2010).

All students are unique with particular strengths and areas of growth; we know that students with disabilities require different learning techniques and instructional supports. School librarians who leverage their professional expertise and access to resources play a vital role in the concerted efforts of caring educators who seek to empower students with disabilities to learn. Consider using digital libraries to connect your students and teachers with learning opportunities in formats that work best for them, and watch their excitement about science catch hold.

Anne Marie Perrault is an assistant professor in the School of Library and Information Studies, Graduate School of Education, University at Buffalo. She investigates how resources and services provided by school and public librarians can empower children and young adults with disabilities. She is currently involved in a project to create professional development for librarians in this area based on her research findings.

Works Cited:


SCHOOL LIBRARIANS AS DIGITAL
The Michigan Teacher Network Project

Laura Stroup
laurastroup@yahoo.com

Mary deWolf
mary_dewolf@hotmail.com

Margaret Lincoln
MLincoln@LakeviewSpartans.org
THE MICHIGAN TEACHER NETWORK (MTN) offered access to thousands of professionally selected PreK–12 digital resources specifically chosen to aid Michigan learners and educators. The users of the site included educators, student teachers, pre-service teachers, parents, teachers, school administrators, support staff, technology specialists, school librarians, media specialists, and other related school staff.

The very strength and core of the MTN project was the collection of digital resources that were meaningfully selected by skilled and highly qualified school librarians. The MTN digital librarians had graduate degrees in information and library sciences, and were often school librarians with prior classroom experience. Many of the digital librarians had subject area specialties in core curriculum areas, as well as in arts education, physical education, special education, professional development, and school services. The team of digital librarians worked remotely and independently to review, evaluate, select, and describe digital resources for the MTN collection. Through school involvement, as well as through professional writings and presentations, digital librarians also shared their work throughout the academic school year to promote MTN to the Michigan educational community. An MTN PowerPoint presentation slide is shared in figure 1.

The MTN digital librarian team used their knowledge and skills in collection development to build and enhance their assigned content areas’ digital resources. This effort included not only the process of continually adding new resources but also reevaluating the collection throughout the year to ensure a strong collection across all areas. The strength of the MTN collection was the digital resource record created by the digital librarian. This record provided users with many informative details about the resource including a title, record description, author(s), content area subject, keywords, additional keywords, resources types, and correlating benchmarks and standards.

Several years have passed since the inception of the MTN project. This current article, however, has provided an occasion for three former MTN digital librarians to reflect back on a very meaningful professional experience. The librarians found that their own practice and instructional role, especially in the area of collection development, was enhanced by the work undertaken for the MTN project.
My work with the MTN project began while I was completing my Master’s degree in Library and Information Science at Wayne State University in Detroit. I had always known that my prior secondary education classroom experience was a strong foundation for my role as a school librarian because my background was fortified with knowledge of the state benchmarks, standards, and learning outcomes for students. These previously held skills, combined with my emerging study and daily work in collection development, aided me in selecting outstanding digital resources for educators.

I believe that having the unique experience of being trained formally with the intention of working in a school library while starting my work with the MTN project brought new awareness to how I viewed collection development work. Working with a strong collection development policy and standards that stressed quality over quantity of resources reinforced the need to make MTN the most essential well-rounded resource for Michigan’s educational community.

I worked hard to make sure that the digital resources were exceptional and that reviewing, evaluating, and putting them into the database online were good uses of my time. A great deal of time was spent using the site as if I were the educator wanting to find a resource to supplement and enhance a lesson or a planned unit. I found that looking at the site critically from the two perspectives, as an educator and as a school librarian, helped me see right from the beginning if a potential resource was one that I would recommend and want our users to come back to time and time again. Resources were evaluated critically, not only from a pure usability standpoint, but also from the scope of the complete resource context, authoritative background, and resourcefulness of the material presented.

My focus was ensuring that these virtual resources remained as true to their original description as when they were first entered into our database by our digital librarian team. We completed annual collection resource reviews, in which we checked each resource record, and I also executed weekly link checks. These regular activities became important components in keeping an accurate and up-to-date collection that we were proud to share. I found that these reviews by our entire digital librarian team mirrored the efforts of rigorous collection maintenance and evaluation performed in a traditional school library. Yet when considering digital resources, it is critical to remember that Web content could change more rapidly than a book’s next edition. The attention to keeping our thousands of links relevant and functioning was vital to the success of our site.

My own work was not as solitary as it may sound, working remotely and spending a great deal of time immersed in collection work and review. In a traditional school library setting, a school librarian does a great deal of work in fostering teacher outreach, collaborative teaching, curriculum support, research skill instruction, and reinforcement for students and staff. Similarly, my work as clearinghouse librarian took me into varied professional settings for resource sharing, collaboration, and instruction with educators at school in-services, workshops, conferences, consortia, and meetings. In addition, sharing with fellow professionals at conferences and workshops in both
the library world and my subject area specialty gave me the opportunity to learn about emerging new digital resources, media, and collections.

In the program description shown in the screenshot in figure 2, several members of the MTN digital librarian team had the opportunity to highlight what was learned from the project, as well as share behind-the-scenes collection development work in a presentation at the Michigan Association for Media in Education (MAME) 29 Conference in November 2002.

It was always a privilege to share the resources of the collection and engage our users in the most effective way to use the site. I enjoyed having the time with users to see what portions of the site they found valuable and worthy of their time. Also, using the power of an informal reference interview helped me gauge the expanding resource needs of our users. Answering impromptu e-mail queries to aid lesson planning, finding specific digital resources online, and locating other materials helped me see what our users required to be successful in their classrooms. User feedback and recommended Web resources were also essential in keeping track of new resources and media in all content areas. I was always appreciative of feedback from users about areas of the collection they found the most helpful, as well as inquiries into where more collection work was needed, as offerings on the Web in some content areas could be challenging.

The Michigan Teacher Network achieved success in providing its intended users with a portal to digital resources professionally selected for educators’ use. Although the MTN project eventually ended and was no longer administered by MERIT Network, the site content has fortunately not been lost. Many of the original recommended MTN materials have been added to Michigan Online Resources for Educators (MORE) on the Michigan eLibrary (MeL) site at <http://more.mel.org>. A joint project of the Library of Michigan, the Michigan Department of Education, and Wayne State University, MORE is identifying thousands of quality educational websites tied to Michigan’s curriculum and professional development needs.

Laura Stroup
worked as clearinghouse librarian and as digital librarian for the Michigan Teacher Network project.
When I was first encouraged to become a collection development specialist for the Michigan Teacher Network, I could see that the role was a perfect fit. It combined continued work in my two loves: education and libraries. My training and experience as a working school librarian provided a foundation of knowledge, skills, and experience that supported an ability to deal with change, a critical skill in today’s world. Those skills and abilities were put to good use in my work at the Michigan Teacher Network.

As a school librarian, my education included a strong background in library and research skills. At Holt Public Schools, where I was employed, my library colleagues and I liked to refer to our team as our schools’ CIO’s—Chief Information Officers. We filled that role not only for students, but also for our professional colleagues in all subject areas. Knowledge of what resources teachers need to help their students achieve was critical to my work at MTN. Ready familiarity with search strategies and terms when using both print and electronic sources was critical in making the resources we found for MTN readily accessible for teachers.

School librarians in Michigan are required to hold a teaching certificate. In my case, I had a certificate in social studies and had used that certificate to teach social studies courses while serving as a school librarian, both in a small school where the school librarian position was part-time and as a team teacher in a cooperative partnership with Michigan State University. The training and experience in teaching are very special parts of becoming a school librarian, and they helped me develop an MTN social studies collection that would be useful to Michigan teachers.

As is common, I was the only school librarian in my school building of approximately 1400 students. The upside of this situation is that I worked with all teachers in all subjects. In our school, student-centered work was the favored form of instruction. As a result, the library media center was well used by students in not only the traditional subjects of social studies and language arts but also in science, math, art, business, etc. Because our school valued collegiality, I coplanned the projects with the teachers. Within the social studies discipline, I worked with teachers and students in sociology, psychology, history, government, and economics courses at several grade levels. This experience was also critical to my work in developing a complete and inclusive MTN social studies collection.

In addition to keeping up with the changing technology independently, I took courses or workshops with each new innovation. This experience and continued training enabled me to fulfill the role of building technology specialist throughout my career. Training and experience also helped me as an MTN digital librarian, as the process for entering and maintaining our collections evolved as the project continued.

Mary deWolf is retired from the Holt (MI) Public Schools system where she worked as the Holt Senior High School library media specialist. She is a regular contributor to The Crossville Chronicle and is continuing in the education profession as an online teacher for Educate Online, Inc.

As is common, I was the only school librarian in my school building of approximately 1400 students. The upside of this situation is that I worked with all teachers in all subjects.
As a veteran school librarian who earned an AMLS in 1973, my computer training had been gained on the job and through graduate-level educational technology certification received in 1996. The knowledge of cataloging and classification procedures practiced for many years in the pre-online world served me well in transitioning to do the work of an MTN digital librarian. When adding a new record or resource to the MTN database, exact guidelines were followed. Information was put into specific fields such as title, author, browsing category, resource type, accessibility, commercial content, URL, description, keywords or ERIC descriptors, technology requirements, grade level, setting appropriateness, and benchmark correlations. Perhaps the most important field to be completed was the description, which attempted to be a brief but pithy attention-grabbing write-up of the site’s merits. The description’s first one hundred characters (with spaces) would be the content to appear on the page of initial results when a search for resources was conducted. Proofreading and revisions were essential before a record was saved and went live in the MTN public database.

Creating a new record for MTN required a concentrated effort. Identification and location of possible worthy sites could not be accomplished quickly and easily using a search engine. There was no option to Google, for example, “calculus resource appropriate for MTN.” Once a site was selected for potential inclusion into MTN, it was necessary to navigate, explore, and familiarize oneself with the main page and subpages. After investing considerable time and casting more than a cursory glance at a site, I often felt that I truly knew this resource and might be more inclined to suggest it to a colleague. A similar phenomenon occurs with original cataloging, where the act of handling and analyzing a book somehow better engrains it in our memories.

Responsibility for collection development is another component of school librarianship that had applicability for the work of an MTN librarian. A school librarian model job description put forth by Riedling in 2001 (based upon a survey analysis) points to the librarian’s role in selecting and evaluating materials and technologies that support a school’s curriculum and educational philosophy. An understanding of course content and curricular requirements at the district and state levels equipped me to make informed choices about which resources to include in MTN. A strong subject background in French language and literature (my undergraduate major and secondary teaching endorsement) qualified me to review MTN resources in this discipline.

Figure 5. ALA Grassroots presenters: Barbara Fardell (Manager, Educational Technology at Michigan Department of Education; MORE Portal Director), Margaret Lincoln, Deb Biggs Thomas (Michigan eLibrary Coordinator at Library of Michigan; MORE Marketing Manager).
Several opportunities for professional development occurred during my tenure as an MTN librarian; these experiences helped broaden my knowledge base of Web resources and technology integration. In 2001 I became a database trainer for the Library of Michigan and began handling instructional sessions on the statewide resource network available to Michigan residents, often including information about MTN in these trainings. In the local Battle Creek area, I assumed a leadership role in Project TIME (Technology Integrated into Meaningful learning Experiences), a U.S. Department of Education Technology Innovation Challenge Grant for the years 1999–2004 (Ashburn and Floden 2006). Within the context of Project TIME training sessions, I was able to introduce area teachers to MTN resources (see figure 3). Finally, during this time period (2000–2003), I served as an American Memory Fellow with the Library of Congress and a Mandel Fellow with the United States Holocaust Memorial Museum. These fellowships allowed me to become better versed in Library of Congress online primary source materials and in the Museum’s Holocaust instructional resources, and to incorporate this learning into my work as an MTN librarian.

MORE

Due to my prior connection to MTN and my current association with the Michigan eLibrary (MeL), it seemed logical that I should continue to be involved with the Michigan Online Resources for Educators (MORE). During the summer of 2009, I joined a team of teachers, school librarians, and library/information science graduate students who input supplemental resources into MORE and aligned with state standards an additional 55,000 recommended online resources from the Verizon Foundation’s site <http://thinkfinity.org>, Gale Cengage, and other content providers. Together with Michigan eLibrary Coordinator Deb Biggs Thomas, at the ALA 2010 Conference I gave an ALA Grassroots presentation about MORE resources and how this open source project can be replicated in other states (see figures 4 and 5). Just as I had incorporated MTN instruction into MeL database training sessions, I now provide colleagues with the basics on how to effectively navigate the MORE website. Through workshops and one-on-one instruction, we consider how to do a basic keyword search, a search by Grade Level Content Expectations or High School Content Expectations (GLCEs or HSCEs), a Browse by Subject search, and an Advanced Search.
A teacher can successively drill down through the content expectations, strands, and standards. For example, in the screenshot in figure 6, the Math 9–12 listing is expanded to see the breakdown of Strand 1: Quantitative Literacy and Logic with Standard L1 (Reasoning About Numbers, Systems and Quantitative Situations) falling under Strand 1. The inclusion of a computer icon means that an online MORE resource is associated with the specific standard.

Because the MORE portal is very much a 21st-century resource, educators will find good support and helpful social-networking tools. MORE offers a Resource Locker, a Lesson Plan Builder, and Collaboration Center offering the following features: a blog, discussion forums, documents, live chat, polls and quizzes, and a wiki. There are also prospects for supplemental STEM content to be added to MORE from such respected contributing partners as ArtsEdge, EconEdLink, Smithsonian, EDSITEment, ReadWriteThink, and Science NetLinks. MORE, like its predecessor MTN, is a true asset for school librarians seeking to provide quality resources to promote meaningful teaching and learning.

Figure 6. Searching MORE by Content Expectations.

Margaret “Gigi” Lincoln is district librarian for Lakeview Schools in Battle Creek, Michigan; a database trainer for the Library of Michigan; and a 2008 recipient of the Carnegie Corporation/New York Times I Love My Librarian Award. She has been an American Memory Fellow with the Library of Congress and a United States Holocaust Memorial Museum Teacher Fellow. A true lifelong learner, she earned a Ph.D. in library and information sciences from the University of North Texas in 2006.

Closing Thoughts from Laura Stroup

These varied experiences, shared by members of the MTN digital librarian team, demonstrate the multiple approaches, applications, and techniques that school librarians use when putting collection development into practice. Each of the school librarians allowed her foundations in collection development work to be her guiding principal in meeting the digital resource needs of the MTN user community of educators and learners. The MTN digital librarian team enjoyed a unique professional experience of virtual collaboration to build an outstanding collection of digital resources. As an added benefit, the MTN project work enhanced the work of the school librarians as they worked in their own schools and districts.

We hope that our wonderful experiences encourage all school librarians to feel confident collecting and promoting digital resources, contributing reviews and ideas for resources to digital libraries like the ones mentioned in this issue, and participating fully in collections’ transformation to digitally rich 21st-century learning resource bases!

Works Cited:


As I was developing the curriculum guide for my nonfiction picture book *When Rain Falls* (Peachtree 2008), I wanted to include a fun activity that would bring the book’s science concepts to life for young readers. I wracked my brain for ideas, but nothing seemed quite right. Then, as I was drifting off to sleep one night, two words suddenly popped into my mind—Readers Theater.

Readers Theater (RT) includes all the excitement of performing a play, but none of the hassles—no props to track down, no costumes to sew, no sets to build. Sometimes students memorize their lines, but more often they read directly from a script, using intonation, facial expressions, and gestures to create characters that transport the audience into the story.

Children are natural performers, and they love using their imaginations, so RT makes reading practice an adventure instead of a chore. As students read and listen to the same lines over and over, they gain mastery over the text, and studies show that the improvements in fluency, vocabulary, and comprehension carry over to new and unpracticed texts.

Do Nonfiction and RT Mix?

Could I really adapt my nonfiction picture book text into an RT script? There was only one way to find out. I spent the next few weeks reading every RT script I could find. I also read books and websites with information about writing and performing RT. But I found no mention of nonfiction.

Still, I was sure that students would embrace nonfiction-based RT. I could clearly envision them taking on the roles of the sun, the moon, and the planets, or pretending to be cells inside the human body. And since kids love animals, I thought scripts with animal characters would be an ideal way to integrate learning and literacy.

During school visits, I’ve seen firsthand that when a child takes on the role of an animal character, he or she feels an immediate connection to that creature. While pretending to be a slithering snake or a little ladybug, students suddenly see the world from that animal’s point of view. And in the process, they gain a deeper understanding of the creature’s behaviors and lifestyle, as well as its place in its environment.
Now, I was committed to creating an RT script based on my picture book. But I wasn’t sure how to get started. That’s when I had the good fortune of meeting Toni Buzzeo at a writer’s retreat. Besides being an award-winning children’s author, Toni is a smart generous person who worked for many years as a school librarian in Maine. She is also the author of Read! Perform! Learn! 10 Reader’s Theater Programs for Literacy Enhancement (Upstart Books 2006).

Toni assured me that my picture book was perfect for RT and even helped me write the first few lines. After that, the script composed itself in my mind faster than I could type the words.

Choosing Animal Books for RT

When I began sharing the script with teachers, school librarians, and media specialists, I was delighted by their enthusiasm. They immediately saw the benefits of combining science learning and RT. Some requested advice for creating additional scripts for elementary students. Others wanted to guide middle-school students in writing RT scripts that they could perform for younger children.

To answer these requests, I searched for other science-themed picture books that could be transformed into RT scripts and identified their common characteristics. I discovered that some science titles best suited for RT adaptation are shelved in your library’s J591 section (animal behaviors). Books like Leaving Home by Sneed Collard (Houghton Mifflin 2002) and Move! by Steve Jenkins (Houghton Mifflin 2006) include information about many different animals. And each of those creatures can become a character in an RT script.
Home at Last by April Pulley Sayre (Holt 1998), and my books When Rain Falls (Peachtree 2008) and Under the Snow (Peachtree 2009) feature lyrical language and repeated phrases that can further enhance RT scripts.

Many books in the J570s section (ecosystems) are also perfect for RT because they describe the roles various creatures play in their environment. Some especially good choices are Frog in a Bog by John Himmelman (Charlesbridge 2004) and Rain, Rain, Rain Forest by Brenda Z. Guiberson (Holt 2004).

Crafting a Script¹

Most RT scripts adapted from fiction titles have just a few parts, but scripts based on the books mentioned above can easily include a role for every student in the class. If you are working with a small group, some animals in the book can be omitted, or students can perform multiple roles. If you have a large group, readers can share a role. In addition to animal character roles, a script should include several narrators to introduce the animals and provide transitions between scenes. The best RT scripts also include a few choruses—lines spoken by many or all of the performers. They help students stay focused and foster camaraderie.

While narrator speeches are usually best suited for advanced readers, animal roles should vary in difficulty to accommodate children at various reading levels. For struggling or reluctant readers, create parts that consist of an animal sound and just a few simple words. For average readers, create text that is a bit more challenging.

Don’t be afraid to modify the author’s text to meet your needs. Focus on parts of the book that you think will resonate with your student population, and cut sections that seem too advanced. Try adding jokes, puns, or even animal sounds to make the readings more fun. Your ultimate goal is to create lively, engaging scripts that students look forward to practicing and performing.

Melissa Stewart is the award-winning author of more than one hundred science books for children; she speaks frequently at schools, libraries, and educator conferences. You can download her science-themed RT scripts at <http://melissa-stewart.com/sciclubhouse/teachhome/readers.html>.

¹ Before a Readers Theater script based on a published book is shared with colleagues or performed outside your library or classroom, please request permission from the author. You can contact most authors via their websites or through their publishers.