Provide a description of the overall instructional program, including models, curriculum, design, methods, etc. Also include a school calendar for a minimum of 180 instructional days for the upcoming school year.

INSTRUCTIONAL PROGRAM

We believe that every child has a right to a quality education and that children learn best when given the opportunity to link what they are learning with real world experiences in an atmosphere that is safe, stimulating and challenging. In formulating the MDCS instructional plan, we begin with the assumption that every child has not only the natural ability to learn, but also the propensity and desire to learn. Our primary responsibility is not to teach students *how* to learn, but to recognize the ways in which they learn, and in turn, to give each one the opportunity to learn. It is our belief that in a school where different learning styles are addressed, children will readily achieve academically ambitious expectations.

In support of these beliefs, the founding members of Mountain Discovery Charter School will use six common anchors as the foundation of a valuable learning experience for our children, teachers, parents and community.

Academic excellence. This will be the paramount expectation for every student. We expect students to develop a core body of shared knowledge providing a solid, coherent foundation of learning, while allowing flexibility to meet the varying needs of each individual.

A committed circle of educators. We will expect our teachers to commit every day to serving and challenging the whole child, emotionally, mentally, socially, and physically. Parents, who we acknowledge as a child's first and foremost teachers, will be expected to contribute life experience, knowledge, and talents. In addition, we intend to partner with the community to offer a network of technology and human services.

Provide opportunities for children to acquire not just knowledge, but a deep experience related to the world around them. Our instructional approach will provide real-life applications for newly-presented material, and place skills in context. In order to enhance and strengthen basic academic objectives, each child will be given the opportunity and strongly encouraged to learn three skills that will complement and strengthen his or her course of study. These will be to exhibit competency in a handicraft, communicate in a second language, and to play a musical instrument.

Integrate maximum use of our geographic location. The neighboring Great Smoky Mountains National Park, Nantahala National Forest and Qualla Boundary of the Cherokee Indian Nation offer unparalleled opportunities for learning experiences that integrate our comprehensive curriculum and promote our community circle. At MDCS we intend to make full use of our natural history, southern Appalachian heritage, and multi-cultural resources.

Add value not only to our students' own lives but also to the lives of others. By developing and modeling a fundamental respect for diversity, by teaching tolerance and appreciation for our differences, and by seeking knowledge through these differences, our students, parents, teachers and community will foster an all-inclusive learning environment. Through our curriculum and instructional approach we will offer many opportunities for our school community to contribute to the welfare of the larger community.

Foster a sense of pride in accomplishment. If children are to become productive, active citizens, they need the confidence and the capacity to take risks and meet the increasingly difficult challenges of our world. Our instructional approach is designed to meet this goal.

We will use these anchors as touchstones to keep us focused on our mission to provide the learning environment children need in order to achieve academic and personal excellence.

FUNCTIONAL CURRICULUM

The MDCS curriculum will follow the North Carolina Standard Course of Study (NCSCS), with additional guidance from the Core Knowledge Sequence (CKS). A major component of the CKS is a coherent flow of content from grade to grade, designed to encourage steady academic progress as children build their knowledge and skills from one year to the next. An example of this Sequence is provided in Appendix J. Because the CKS is particularly strong in the process of building on skills instruction grade by grade, it can only strengthen the depth and breadth of the NCSCS. The combination of the two will provide the firm foundation and cohesive learning continuum required in order to fulfill academic excellence expectations at Mountain Discovery Charter School.

INSTRUCTIONAL APPROACH

The MDCS instructional approach will emphasize learning by doing, with a particular focus on literacy. Our definition of literacy includes not only words, but creativity, critical thinking, and community contributions across the disciplines. It is well documented that an experiential learning approach has a strong positive effect on student understanding and achievement, and the best practices of experiential learning are certainly not unique to any one model. However, we have found that our educational philosophy and objectives are particularly matched by the principles of Expeditionary Learning, an approved New American Schools design that grew out of the work of Outward Bound's Kurt Hahn and other educational leaders from Harvard University.

Expeditionary Learning: The Five Core Practices

The Expeditionary Learning model is built upon the five core practices described below. Mountain Discovery Charter School will incorporate all of these in the course of a strategic multi-year implementation of Expeditionary Learning. The ten design principles of Expeditionary Learning are listed in Appendix K. Documentation of the success of expeditionary learning is provided in Appendix L.

1. Learning Expeditions

The nuclei of the Expeditionary Learning approach are in-depth investigations of topics that engage students through authentic projects, fieldwork, and service called "learning expeditions." These expeditions engage many different learning styles and require significant interaction with the larger community, providing real-life applications and placing important academic skills in context.

At MDCS, learning expeditions will bring experts into the classroom and take students out into the community to conduct fieldwork, engaging students in real-world activities both on and off the school campus. Learning expeditions are never simply field trips. They include scientific experiments, interviewing, collecting data, sketching, or examining original documents or artifacts. They are *always* tied to clear academic goals and require the application of skills in ways that reinforce understanding and facilitate expression. They demand advance planning, study, and rubrics supplied by the teacher in preparation for the work. In addition, the results of these projects always have an audience beyond the school itself. Expeditionary Learning has been described as "education for the gifted, extended to everyone." There is no tracking. Students collaborate with, critique, and help one another to do their best work.

In one real-life example at an Iowa elementary school, fifth graders made a quilt to be sold to benefit a local charity. The entire project was conceived, designed, and executed by the students, with guidance from teachers. The children researched quilt patterns, drafted designs, chose colors, measured and calculated the amount of fabric required, raised money to buy the cloth and then purchased it, cut the fabric, stitched it by machine and then finally quilted it by hand. A whole school, year-long learning expedition with a water theme, conducted at one Colorado school, is described in Appendix M. Our own region has many wonderful resources that offer endless opportunities to integrate the disciplines. Our students may be involved in projects like conducting an environmental field study of salamander habitat in the Great Smoky Mountains National Park, compiling an oral history of local mountain families, or making an investigation

into the ways English folk ballads have evolved into Southern Appalachian fiddle tunes. These studies will culminate in an exhibition or performance open to the larger community.

2. Reflection and Critique
Reflection, critique, revision and collaboration are critical to the process of Expeditionary Learning. By their very nature, these processes foster respect for self and others, develop understanding of and pride in diversity, and build character and thoughtfulness. They are included in every expedition. Mountain Discovery Charter School teachers will be afforded the time for and be expected to model the culture of reflection and critique, both as an example to students and in their teaching duties. Through examination and assessment of student work, teachers will discover what students know and how they learn, providing information on how to improve instruction. Using specific Expeditionary Learning protocol in their discussion and critique of instructional practices and learning expeditions, teachers will work to improve their craft in a collegial and respectful forum.

3. School Culture
MDCS will uphold a set of shared beliefs and practices regarding learning, teaching and assessment of all students. Our circle of educators will promote academic excellence in a strong culture of best effort and revision in which many drafts are the norm and nothing less than best work is expected. Students will keep portfolios of their work, including examples of brainstorming, drafting and self-critique, and will use them to demonstrate that the heart and beauty of learning lies not merely in the final result but is in fact rooted in the process.

MDCS teachers and administrative staff will act as facilitators to student learning. Staff will work together as a group, creating a clear and common direction for the school. Not only will they facilitate student learning, but they too will be learners. Our team of teachers will provide feedback to each other, helping increase the effectiveness of our staff by continually improving performance and renewing the commitment to teaching and learning. Students will play a major role in creating school and community service programs. Through these they will develop a sense of responsibility for themselves and their world.

School culture will also demonstrate how individual and collective behaviors support an environment where adults and students feel emotionally and physically safe and are free to take risks and go beyond their perceived limits. As a community, the staff, students, and parents will take collective responsibility for the learning of each and every student.

Mountain Discovery Charter School will operate on the premise that the best learning takes place when learners are having fun. Our classrooms and expeditions will provide fun, challenge, skill, and knowledge, and create a sense of belonging for each and every member of our learning community, including those outside the school campus.

4. School Structure
To help create an environment that will promote an expansive learning experience, MDCS will provide flexible blocks of time for project-based study and fieldwork, group planning and shared decision-making activities such as community circles. We believe our schedule should be adjusted to fit learning priorities, rather than molding our objectives to fit a traditional schedule. Our school calendar, which is organized into nine-week trimesters, reflects this adjustment. It is provided at the end of the instructional plan.

Positive relationships between teachers and students are vital, and each relationship is unique. Recognizing this, MDCS will cater to the many different learning styles students will bring to the school. Class sizes will be small, with a student-to-teacher ratio of 16:1. Variable student groupings will allow different types of student-to-teacher and student-to-student interactions, such as intensive coaching and cooperative learning. To enhance our teacher-to-student relationships, we will support looping, so students may stay with the same teacher for up to three years. To best serve our community of learners, our school will feature integrated opportunities for age-appropriate play and ability-level learning across the grades.

At MDCS, teachers must demonstrate their commitment to life-long learning not only for their students but also for themselves. We expect our teachers to develop an area of specialization so that they become

resources for consultation, advice, and continual growth for the entire community of learners. Flexible scheduling blocks will provide time for the full-staff planning, teacher-to-teacher feedback, and mentoring opportunities necessary for effective team teaching.

Our teachers will work together and be paid for an eleven-month school year. During this time, they will collaborate with and learn from each other to create a rich and rewarding learning environment.

5. School Review

In order to continually improve its methods, practices and effectiveness, Mountain Discovery Charter School will conduct annual assessments of instructional plans, curriculum designs, and learning expeditions to improve the quality of teaching and learning. This review will include collecting and studying baseline data, identifying priorities and establishing goals for improvement, then using this information to make informed decisions about instruction. Parents and community members will become active participants in the school review process. In addition to standardized test scores, the staff will maintain and regularly revise a school review portfolio that reflects the school's progress in implementing the core practices and improving instruction and student performance.

IMPLEMENTATION

Mountain Discovery Charter School will implement the Expeditionary Learning model gradually, planning full realization of the model at the end of five years. Our initial focus will be upon fully engaging our students, teachers, parents and community in school culture and structure.

We intend to contract with Expeditionary Learning field consultants for specific staff training and support, and for assistance in ensuring that our implementation of the approach is aligned with state standards and objectives.

Our plan for 2002-2003 includes the following in-service training for teachers:

1) A five-day summer planning institute on-site, during which Expeditionary Learning consultants will provide technical training and assistance in:

- Incorporating the NCSCS and CKS into learning expeditions
- Development of the schedule to accommodate Expeditionary Learning blocks
- Implementing the Core Practices of Expeditionary Learning
- Implementing MDCS goals concerning school culture and structure
- Conducting a learning expedition for teachers
- Aligning the Expeditionary Learning process with our chosen assessment models

2) Expeditionary Learning consultants will maintain contact with teachers and provide on-site support for two days each trimester. In addition, staff development and continuing education will include attendance at Expeditionary Learning site seminars, leadership retreats, and courses for educators along with visits to other Expeditionary Learning schools. An educator's course description is provided in Appendix N.

We will continue to work with Expeditionary Learning field consultants over the next four years to further define and develop our instructional plan, concentrating on fully implementing our approach in the way that will best serve the learning community of Mountain Discovery Charter School.

Water: A Whole School Expedition

By Ron Berger

Reprinted from *Journeys Through Our Classrooms* (Kendall-Hunt Publishing, Dubuque, Iowa, 1996)

Ron Berger describes a yearlong interdisciplinary expedition on the theme of water which involves his entire elementary school and the surrounding community. Students from kindergarten through sixth grade study water as a resource, along with its physical properties and biology. The aesthetic dimensions of water--its presence in literature, music, song, poetry, and painting -- provide a common thread that runs through the students' investigations. Children draw upon the talents and interests of town residents, local experts, and a college professor and his class to help them with their research. As a culminating study, students tested the town's drinking water for lead and sodium contamination. The students keep the community and the local paper apprised of their findings. But as the testing progresses, Berger and his colleagues begin wondering if they have a public health crisis on their hands.

In my school, curriculum and instruction are centered in thematic studies. Teachers design original units to use with their classrooms, and these units represent long-term expeditions into different worlds of knowledge. Every once in a while the staff feels brave enough, or crazy enough, to attempt a whole school expedition. The most vast and ambitious of these was a yearlong whole school journey into the theme of water. For an entire year, kindergarten through sixth-grade students were immersed, so to speak, in literary, artistic, mathematical, ecological, political, athletic, scientific, and playful aspects of this broad topic.

My fear in trying to recreate this study to share with others was that my fondness for metaphor and my terrible sense of humor would join forces against my will to insert puns into every sentence. I found myself describing students as "plunging into studies" or "getting their feet wet" with activities. I myself have been "wading" through data in preparing this account, "filtering out" the important issues. In describing the most intense moments of this study, when it sank in that the research of students could uncover serious health hazards for town citizens, creating a panic for families, I remembered how often we felt that we were "over our heads" in taking on this project. I've tried valiantly to cleanse my language of this affliction. Kidding aside, this process made clear to me the ubiquitous and almost archetypal presence of water images in our language and in our thinking.

While it's important to explain the study's goals, activities, scope, and sequence, I also want to convey some of its spirit and life. A goal such as "investigation of aquatic reptiles" is less vivid than my memory of two sixth-grade girls stalking a large water snake through a weedy swamp, waist-deep in muck and water, then hitting an unexpected underwater hole and disappearing below the surface of the water.

I think of first graders, digging channels in the sand, struggling with giant buckets of water to begin the life of a stream. I think of third- and fourth-grade students on a rowboat out in the middle of a town lake, carefully lowering into the water a clever homemade water-sampling contraption built of rope, hardware, duct tape, cork, rocks, a wine jug, and a thermometer. More than any thing, I think of the excitement and fear in the classroom as my students compiled and reported data from town well samples. The children, teachers, town families, the town board of health, and the local newspapers were awaiting these results with impatience and apprehension. But everything was in the children's hands, and there was no rushing them. With the lives and health of real people at stake, the students refused to post anything until it had been checked and rechecked. They were as terrified of making a mistake as we were of uncovering a crisis. This was serious business!

Let me put this study in context. I teach sixth grade in a rural public school in western Massachusetts. It's a small school in the woods, financially poor but rich with ideas and energy. At the time of this study we had about 140 students and seven teachers. We are privileged in having a small, creative staff who respect and enjoy each other. We are anything but privileged in the physical and financial conditions of our work.

Every few years we muster up the courage to organize a theme of study for the entire school. As with many phenomena in life (childbirth is an example used by some mothers), after a few years we seem to remember the good parts of these whole school extravaganzas and forget the degree of pain, problems, and mess. Even though every teacher on our staff has individual talent and dedication in developing his or her own classroom themes, schoolwide themes require more time and a much higher degree of coordination. With time, though, the memories of headaches fade and the staff (at least the more optimistic or senile among us) grows nostalgic for that wonderful celebration of learning, discovery, and sharing that permeates the school during such an adventure.

The impetus for choosing water as our topic of study was an interesting one. One of our staff, third- and fourth-grade teacher Ken Lindsay, took a year's leave of absence from school to pursue a number of educational projects. During this year, the town where he lived became embroiled in a frightening water contamination crisis: private wells had become contaminated with dangerous pesticides from agricultural sources. Ken jumped into a leadership role in the citizens' group investigating this crisis, fighting for well testing and emergency water distribution. (Several years later these efforts finally paid off. The town agreed to build a $4 million water system, partially funded by the state, to replace half its delivery system for private wells.) Needless to say, Ken got little else done that year. Ken returned to school the next year with a new expertise and sensitivity concerning water as a resource for life. The rest of the staff, having had our own wells tested during that panic year, had been awakened also. We felt a responsibility to impress upon children the importance of this issue. And so, when discussions began in January about a possible topic for our school study next year, water rose quickly to the top of the list.

Planning

The staff began that February and March with brainstorming sessions of all the possible topics, activities, and concepts that could fall under the umbrella of water studies. And, as with my problem with wet metaphors, we found the topics to be almost endless. Our first session yielded about one hundred ideas and resources. From here, the planning began. I was lucky enough to work with Ken on the smaller staff committee entrusted with shaping this vast list into something manageable.

Ken and I wrote a small grant proposal, seeking state funds, and were lucky enough to receive a $3,000 grant for staff development around this theme. This money had a great impact on our planning, as it allowed us to hire experts to teach the staff, and fund educational activities for staff members.

The greatest resource a school has when it embarks on a learning expedition is the creativity, energy, and cooperative spirit of the staff. This is a resource, like water, that is often taken for granted: it is drawn upon constantly, with little effort to renew and refresh it. Our project committee worked with the staff to design a spectrum of staff activities to address this. These activities included trips: a boat trip down the Connecticut River with an expert guide, a canoe trip for staff and families, and even a whale watch off the coast of Massachusetts.

These activities were intended to accomplish three things: first, to inspire the staff-to build interest, enjoyment, cooperation, and spirit in a watery world; second, to provide diverse forums for staff to plan and work together in small groups or as a whole group, free from school pressures; and third, to provide training experiences for the staff in different scientific and ecological aspects of water so that we would have a base of knowledge for beginning.

Whenever possible, we included the full school staff, not just the teachers; the cafeteria manager, secretary, custodian, and all support staff were invited to our boat trips, whale watch, and lake studies. In practice, the activities did not always focus on a single goal, such as morale, science education, or planning time. Many events addressed all these goals at once.

The Study Begins

We loosely divided the water study into three phases. The fall would focus largely on water as a resource, the winter would focus on the physical properties of water, and the spring on the biology of bodies of water. It was difficult to keep to these distinctions once we got going (when you've got three children out in a rowboat, it's hard to tell them to ignore the fish and think only about water temperature). The phases were

helpful in organizing the major emphasis of our investigations in the classrooms and the school. The aesthetic aspects of water-watercolor painting, the literature of water and the sea, water poetry and stories, whaling ballads and water songs, sand castles, and so forth-were a thread that ran through all phases in myriad ways.

Field trips and visits by local experts have always been key to our classroom thematic studies. Not only do they connect the children to the real-life aspects of their work, but they inspire the students to look at resources-whether museums, libraries, people, or ponds-with the respect and excitement that come to newly emerging experts. We generally bring the students on trips or invite experts into the classroom after students have gained a foundation of knowledge and investment in the topic. As the culmination of a study, these events can be wonderful, as students already have the deep background and interest to be polite, absorbed, and excited guests or hosts. Because they are striving to become experts themselves, they often treat expert guests with a hero's welcome.

We used a variety of trips and presentations with children, with single classes, pairs of classes, or the whole school. We visited the New England Aquarium, local fish hatcheries, a fish ladder for salmon and shad on the Connecticut River, a whale watch in Gloucester, Massachusetts, and college laboratories, and took countless trips to local lakes, ponds, streams, bogs, and swamps. The guest experts spanned a wide range, from geologists to parents who worked in fisheries to a folk singer who taught us water songs.

We have a small lake in our town, Lake Wyola, which became a center for our studies. In bathing suits or boots, with field nets, ropes, clipboards, buckets, bottles, bags, and thermometers, students ventured around, in, and on top of the lake. Some of this was done by individual classes. The third and fourth graders went door to door around the lake with a survey for lake dwellers on how they used the lake. They also measured water temperature and acidity in the lake from the shore and from boats, looking for stratified layers and patterns of water movement, and also examined its surrounding streams and swamps. They monitored pH as an indicator of the lake's health for sustaining wildlife. The fifth grade studied fish populations through observation of nests and by using giant seining nets to collect specimens. The sixth grade studied the glacial formation of the lake and its geology, prepared a depth map of the lake through the use of a motorboat with a sonar "fish finder" instrument, and collected and studied reptiles, amphibians, insects, and all sorts of large and small invertebrates.

In addition to these classroom studies, there were two whole school "Wyola Days," one in September and one in June. Everyone -- children, teachers, custodian, cook, parents, and principal -- got wet on these days. On Wyola Days, students from the kindergarten, first- and second-grade classes joined in with their own projects -- sailing homemade yachts, studying river and stream movement, building sand castles, and painting scenes -- while the third through sixth graders continued their various water studies. The students also delved into local history and lore. Two older town residents, "the keeper of the dam" (an official town post, which pays five dollars a year) and the owner of "the pay beach" and campground, met with students and teachers to give some background on the lake over the years. These Shutesbury elders were kind enough to repeat their reminiscences and lessons to different groups of students throughout the day. On this day, the staff learned as much as the children. We included physical science studies of water from many sources; the most significant were units prepared by the wonderful Elementary School Science program. We used unit guides, which were often accompanied by kits that we could purchase or borrow, at many grade levels. All contained hands-on experimental work and lessons in recording and interpreting data. The lower grades used units in Sink or Float and Clay Boats; the middle grades, Color Solutions; and the upper grades, Kitchen Physics and Stream Tables. A workshop by a local educator/naturalist prepared all teachers to investigate the physics of soap bubbles with their classes, and a workshop by a science teacher equipped the upper-grade teachers to investigate acids and bases with their classes through preparing a homemade litmus indicator, a solution of red cabbage juice.

Biological studies of whales, fish, aquatic reptiles, amphibians, and invertebrates occurred at different levels. These classroom units ranged from a few weeks in length to a few months. A local educator/naturalist not only taught staff and children techniques to collect and identify pond and stream life, but also loaned the school equipment to do so, including a projection microscope that turned barely visible specks in pond water into monsterlike creatures on the classroom wall. Classrooms were

overflowing with aquatic life; we purchased ten-gallon aquariums in great number, as well as buckets and plastic trays. Fish eggs, frog eggs, salamanders, insect larvae, diving beetles, perch, and small-mouth bass consumed our days. The bubbling sound of air pumps was a constant drone. That spring the school was filled with paintings, drawings, models, poems, and stories of whales, fish, and dragonflies (in my classroom, even water fleas and leeches).

We searched for literature that embraced watery topics, from sailors and the sea to rivers, rain, snow, ice, fish, whales, and turtles. Teachers and students read books aloud at all levels-from Swimmy, by Leo Lionni, to Huckleberry Finn, by Mark Twain. Some books were used in reading group studies. In addition to our classroom work, our art specialist and music specialist wove watery themes into their work with classes, and our spring school concert was a celebration of water.

Much of the water project work was interdisciplinary, to the extent that it would be impossible to categorize as science, art, math, or language studies; it was all at once. When first- and second-grade students studied fish, they had live fish on every table in the classroom. Children counted them, observed their habits, drew pictures of them, kept journals of their life cycles, created safe experiments for them, and wrote poems and stories about them. These students read fictional and nonfictional stories about fish. Fish words became their vocabulary and spelling challenges. They did watercolor paintings of fish, tempera paintings of fish, tissue paper collages of fish, collages of crayon and ink-stamped fish, and stuffed fish models. They observed fish in the classroom, fish in hatcheries, fish at an aquarium, and fish in local ponds and streams. Students probably couldn't have told you what was science and what was art, but they could have told you an awful lot about fish.

Fit to Drink

We began the year with a focus on water as a resource. Though drinking water may seem like a less compelling subject for children than water snakes or whales, it emerged as the most powerful and passionately pursued topic of the year. Few citizens, child or adult, appreciate the precious resource of clean drinking water that we enjoy in this country. Only in severe water shortages or contamination crises do we begin to see what we usually take for granted. As a staff, we felt it was important to foster an ecological consciousness in our students about water protection and conservation-not through lectures but through real work.

For an adult, raw statistics themselves can be jolting. The average American directly uses about 160 gallons of water per day and indirectly uses about 1,800 gallons, compared with an average of 12 gallons per day for persons in less developed nations. While about 40 percent of the world is without clean, safe drinking water, we use about 60 gallons of clean water to wash a load of our clothes, and about 25,000 gallons of clean water to produce one pound of beef for human consumption.

These kinds of statistics are not always real for children. We needed other strategies to introduce them to the notion of water conservation and protection. A first-grade teacher had each child keep a water log. In school and at home, students kept track of how many times water was used, for drinking, cleaning, flushing toilets, watering the lawn, or for any other purpose. They got parental help when needed, and parents were encouraged to join the study. For a limited time, this teacher allowed students to use water only with a "water ticket," so that they could experience what the world would be like with water rationing. Students learned how much water can be wasted from a leaky faucet by doing experiments with slow drips from the classroom sink. Even if the figure of 200 million gallons, which is the estimated amount of water lost each day in New York City by leaky faucets and toilets, is too large a number for first graders to grasp, they could see how drips add up.

Of all the projects and work accomplished during that year, the most significant was our testing of the drinking water in town. In our county, almost all water is drawn from private wells; town water systems do not exist in most communities. Our own town is entirely served by private wells; our school has its own well. New homes, and of course the school, must test their water and prove to the town board of health that it is fit and drinkable. This requirement does not apply to existing homes, and so most of the townspeople do not really know the quality and safety of the water they drink at home, unless they've been willing to pay

for expensive tests. Even homes that have been tested are not necessarily safe, as conditions may have changed since the initial test.

As far as we knew, no town with private wells had received a thorough testing of its water. It's an expensive process, and testing is done by the state only in times and specific sites of crisis. We had an opportunity, using students and families, to test the entire town of Shutesbury-not every home, but a sampling of homes spread across every part of town. If there were patterns of contamination or concern, there was a good chance we would catch them.

We established a partnership with an ecology class at Hampshire College in Amherst. Professor John Reid offered to make his laboratory and students available to help us. We could not do a full battery of water tests, due to our limitations of equipment and expertise, so we decided to focus on two areas of particular concern for people in town: lead pollution and sodium pollution.

Lead pollution in drinking water is often caused by the lead solder in the joints of metal pipes leaching into the water supply. Even infinitesimal amounts of lead, fifty parts per billion, represent a serious danger. The more acidic the water, the greater the chance of contamination. With our wells being filled by increasingly acidic rain, many people were getting nervous. Third- and fourth-grade pH readings of local streams and pond confirmed our fears that our town's water was more acidic than it should be. Sodium pollution can be caused either by natural ground salts, or when the salt that is poured onto icy roads in winter leaches into the soil and ground water. Some areas in town, particularly homes at the base of steep hills, seemed to have good cause for worry. We resolved to test for sodium and lead content, and also to check the acidity of water samples.

We began by holding whole school assemblies. We explained the project, and answered questions. We described artesian wells-how the are dug, why they work, and how they can become endangered. We sent a letter home to each family, inviting them to participate if they felt comfortable doing so. No family refused, and many were anxious to begin. Attached to the letter was a request that each student, or student-parent team draw a rough map of the location of their well. We asked them to provide an aerial view of the home, road, and well, with approximate distances and slopes indicated. This would enable us to look for a correlation between sodium content and well placement, in case road salt was running down hill into a home's water supply.

John Reid provided sterile sample bottles, two for every child and staff member at the school, and a pile of extras for mistakes. First, Reid taught the sixth-grade students the proper method of drawing water samples. Th procedure had to be followed exactly to ensure accuracy. Then the sixth graders held an assembly for the entire school and gave a lesson in proper sampling techniques. They distributed sample kits containing bottles and instructions to every child, kindergarten on up. Students were instructed to take the samples themselves, or to have a parent help. Any mistakes in the procedure, even a single toilet flush during the night, had to be recorded and turned in with the samples, as it might affect the outcome.

At this point, word of the study had gotten around town. The town board of health was in touch; not only were board members anxious to hear the results, but some of them asked if they could have their own wells tested. Requests for tests came from all over -- relatives and friends of staff, relatives of students, neighbors of students -- everyone wanted their wells tested.

When the samples came in, small groups of fifth- and sixth-grade students brought them down to the Hampshire College laboratory, driven by parent volunteers. In the lab, the fifth and sixth graders were taught to calibrate and run the analysis machines by the college students. While the young students were running the machines under the supervision of the older students, a separate team of fifth and sixth graders videotaped the process with the school's camcorder. Phase I of this project, the analysis of samples, was completed in a few days. Fifth and sixth graders then directed an assembly for the whole school where they explained the process to the students and the school staff, using the videotape as part of the lesson. Our next task was to analyze the data -- enter the results on town maps, arrange and graph the data to look for trends, and assess the degree of the problem in our town.

Meanwhile, some of us on the staff were starting to panic. Initially, this project seemed like both a great learning experience and a public service; it was perfect. Now the gravity of the project began to sink in. What if some family wells had lead content high enough to present a real danger? Who was going to break the news to the family? If students were in charge of all the data, there was no way to keep such a finding secret, or even guarded. What if property values in town were imperiled by our findings? Could we even trust our findings? Were we liable for any problems we created? We called our town lawyer to discuss these issues.

The students, meanwhile, were buried under reams of computer printouts, working in teams to organize and present the data. Lists and charts were created. The third and fourth grades had drafted an extraordinary town map in the school library to record their water acidity findings, a map that took up an entire wall. We marked the home of every student in the school on the map, and entered the data from the well next to the home. This enabled us to look for neighborhood patterns.

Reporters were coming to the school regularly during this period to get updates on the results. Staff members spoke to them, but told them frankly that if they wanted an appraisal of the data so far they would have to talk to the students. Students were analyzing and interpreting the data; they knew more than staff did at that point. Students even talked on the phone with reporters to give updates.

Luckily for us and for everyone in town, no samples revealed levels of lead or sodium that were clearly dangerous. Some samples were slightly higher than recommended levels, and we requested more samples from these homes so we could retest them. There was a wide range of levels of both contaminants in the samples, and our job now was to try to find patterns and relationships in the data.

John Reid taught the sixth-grade students methods of plotting the data on graphs to examine correlations. We examined the following correlations in graphic form: pH to sodium, well depth to sodium, distance from road to sodium, pH to lead, and sodium to lead. We also examined the relationship of the pH of the first water sample taken in the morning to the second sample, taken after the system had been thoroughly flushed out.

Our findings were interesting, and not what we bad predicted. We found no correlation between well depth or placement and sodium levels. There was no evidence that road salt was affecting wells in a substantial manner. Lead levels were acceptable throughout town, but were higher in wells where the water was more acidic. Also, in about a third of the wells, the second water sample was significantly more acidic than the first, indicating that the water had been buffered by sitting in the pipes overnight. Had lead levels been high, this would have suggested that one should run the water in the morning for a few minutes before using any to drink.

These findings were relayed to the school by the students who had prepared the graphs. The students used chart-size versions of these graphs in an assembly to explain to the school their findings, and also to teach younger students how to read such graphs. The findings were also shared with the community and, through newspapers, with neighboring towns. As the use of road salt was a controversial issue throughout the region, our findings held real significance for towns in our area.

Our student scientists felt on top of the world. The work they had accomplished was not only accurate, clear, and elegantly portrayed, but it was important. Not important school work, but important work in the real world. To this day, I'm not sure that any community in the state has more accurate data on possible road salt contamination of wells than these studies prepared by elementary students for the town of Shutesbury. Of course, students wanted to extend and continue the testing work, but the staff declined. We felt as if we had ulcers by now, and thought that some work that was a little less vital would suit us just fine for a while.

Our Shutesbury water study officially ended on a bright, sunny day in June, our second Wyola Day. We loaded into cars -- parents, students, and staff -- and headed to the lake for a day of research and fun. On this day, the research and projects of students were combined with some less serious lake activities: swimming, boating, volleyball, sand castles, and a whole school picnic. In the same way that the morale

and spirit of the staff was nurtured with workshops, trips, and events during this water study, we felt that the morale and spirit of the whole school wouldn't be hurt by a little water fun. What kind of water expedition would it be without bathing suits and splash fights?

Appendix N

Expeditionary Learning: Educator's Course

Reflection on the Cherokee Nation Summit

The following excerpt from From the Inside Out: The Expeditionary Learning Process of Teacher Change *by Denis Udall and Leah Rugen and published in* Phi Delta Kappan *(June 1998, Vol. 79, No. 10), explains the philosophy behind Expeditionary Learning Outward Bound summits and conveys the excitement and challenge teachers experience during the week-long professional development opportunity.*

In a rural North Carolina town a group of teachers is putting the final touches on its closing arguments. The "attorneys" representing the United States government huddle in one corner; those for the Cherokee Nation, in another. The issue: Is the removal of the Cherokee to the west, the infamous Trail of Tears, inevitable, or is there a way out? In the adjacent room, a panel of white and Cherokee "judges" await the oral arguments. The teachers are keenly aware that this issue is not part of the dry, remote past, but a case of living history in which the Cherokee people are still invested; they deeply care about how history will judge them and their ancestors.

Teachers-as-learners. It is a simple idea. But teacher educators are increasingly appreciating its appeal and power for shaping the professional lives of educators.

The approach to teacher development adopted by Expeditionary Learning Outward Bound begins with a simple proposition: when teachers view themselves as learners, they enhance their capacity to reflect on their craft in ways that help them do it better. We have found that when teachers have lived an educational experience and reflected on their own growth as learners, they are better able to grasp the educational value of the experience and to reap its rewards in their own classrooms.

Over the past three years we have been experimenting with a professional development experience-called a summit-that draws on teachers' knowledge about their craft while introducing them to new practices and subject matter.... Summits model the active, adventurous learning that Expeditionary Learning teachers and schools are striving to engage in with their students. A teacher who participates may return home with the framework and content for a specific interdisciplinary unit. Another teacher may take away a set of teaching practices that cut across subject matter and topic. Above all, the summits create opportunities for teachers to reflect on themselves as learners, to deepen their inquiry about their practice, and to think about ways to integrate what they are learning into their own classrooms....

The following section is taken from a journal by Leah Rugen, written while attending an Expeditionary Learning summit called "The Cherokee Nation Trail of Tears." Taught by Bill Anderson, a professor of history at Western Carolina University, in Cullowhee, and Leo Snow, a middle school teacher at the Children's School in Morganton, North Carolina, the summit was held in Cullowhee.

...Wednesday... As a community service project we clean out a densely overgrown cemetery. Bill is eager to see if we can find the grave of Yonaguska, one of the Cherokee leaders at the time of the Trail of Tears. I begin to lose my feeling of isolation in the camaraderie that comes with shared labor. Together, we slash through weeds and bushes, trying to avoid the copious poison ivy. We finish clearing a steep path, and arrive at the entrance to the cemetery. In a couple of hours we have cleared a space around the grave-sites, where, to our delight, we locate a rock pile that is probably Yonaguska's grave. It seems that by honoring the dead we have honored the past and present and have engaged with our subject physically as well as intellectually.

That evening we return to the town of Cherokee for a traditional Cherokee dinner. We are joined by 10 members of the Crowe, Wolfe, and Junaluska families who span three generations. We get acquainted over dinner, and afterward, Leo asks an opening question. The evening passes in a fascinating rush of remembrances and ideas. The families speak of contemporary tribal politics, child-rearing practices, and the importance of their large, extended families. They share their commitment to the well-being of the Cherokee Nation, and some speak with eloquent passion about past injustices. For almost two hours they share their lives with generosity and kindness. Sitting in a circle in the twilight, listening intently to the talk, I not only feel more connected to my fellow students but also imagine that we have formed a wider community at least briefly.

Thursday. Suddenly there is only one day left to prepare for our presentations. We don't possibly have enough time. We spend half the day reading, writing notes, and thinking about how we will make our character come alive. We each have five minutes to make a presentation, and we're counting on using what we learned to negotiate a new treaty. We teachers express the same kinds of anxiety that we have heard from our students: "I haven't read enough," "I hate public speaking," "I hope people don't confuse me with my character." There is even a sprinkling of competition as we note who has been studying into the wee hours.

Friday. For nearly three hours I sit riveted, taking notes, as people bring their characters to life. Some have composed speeches that they deliver with passionate oratorical passion. Some have enlisted others for an improvised role playing. Everyone speaks in the first person and, though there is a lot of laughter, we approach our characters with deep seriousness. The presentations are wonderful vehicles for us to teach one another about the complex and interconnecting forces of the time: racism; the different factions within the Cherokee Nation; the pressure of states' rights and the threat of secession; competing concepts of military duty and honor; the clergy, some of whom supported and some of whom opposed the removal; and the extreme economic pressure exerted by land speculation and the massive westward migration. It is exhilarating but overwhelming. How will we ever negotiate a new treaty? Do we have to accept the removal of the Cherokee as inevitable, or is there a way out?

With the knowledge that we'll present our treaty to a panel of white and Cherokee judges, we plunge into negotiations. Initially we break into two large groups: one group is predominantly Cherokee and is emphatically opposed to removal: the other represents "government interests," though its members are joined by the faction of Cherokee who had signed the original Treaty of New Echota and supported the move west. The negotiation extends into the evening. Teachers in leadership roles play them to the hilt, while others provide council, ask questions, and play devil's advocate. Some find it extremely difficult to stay in character, and personal views and emotions keep entering the debate. Others interpret their roles strictly. The process is difficult for everyone, especially for those
who must take on roles of people whose views are antithetical to their own.

Initially, each group develops a separate treaty. But after proposing it to the other side, each group has to go back to the drawing board and contend with the other side's non-negotiables. The exercise of trying to unite competing points of view while respecting historical reality raises many painful questions. Is our compromise a pragmatic, necessary choice, or a sell out of principle? If the extermination of the Cherokee people is inevitable if they are not moved, should we support removal? Can history be reimagined in a way that takes account of what we have learned
from tragic outcomes but also fully acknowledges the complex forces of the time?

Saturday. We enter the "formal hearing" to present and defend our treaties with a high degree of anxiety, knowing that representatives of the Cherokee people and a federal judge will be our audience. The two treaties are reviewed and intensely questioned and scrutinized. Each character is called to the stand and asked to give an opinion. Leo and Bill act as "friends of the court" offering their own questions and making certain the judges do not overlook any vital issues. When the judges finally offer their summary analysis of what they have heard, it is a bit anticlimactic, since by now we know there will be no satisfying resolution, only painful ambiguity.

When we assemble for a final circle for a debriefing, we take a moment to release the spirits of the past and just be ourselves. It will take time to make sense of all we've learned, but in the final discussion people speak of how important it was to be a student again and of the support they got from the group. There will be ample opportunity to apply what we've learned to designing learning expeditions for our classrooms. For now, we appreciate the fact that, by focusing on a single historical character, we have opened up the world of the 19th-century Cherokee.

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