

Why A Time for Science?

A Case for the Support of an Environmental Education and Science Learning Center to be Focused on a “Learn-by-Doing” Approach

He who learns by finding out has sevenfold the skill of him who learns by being told.”

(Arthur Guiterman, 1871 – 1943)

Executive Summary

A Time for Science recognizes:

- That there is an ever increasing disconnect between our nation’s youth and their knowledge, appreciation, and experience of the environment, a disconnect that must be overcome;
- That the wellbeing and preservation of our natural environment is essential to our very survival and must be appreciated, understood, protected, and nurtured;
- That, in this age of information- and knowledge- based industries and of the technical nature of issues and problems faced by society, a scientifically literate and technically competent populace is critical not only to our society in general but to the economic and cultural development of our region in particular and must be cultivated and fostered at all levels; and
- That ***learning by doing*** offers the most effective, exciting, inspiring, and fulfilling approach to environmental education and to the learning of science, mathematics and technology, and that a variety of opportunities for such should be supported and made available to all.

As a unique endeavor with exceptional qualifications within Greenville/Pitt County and its surrounding areas, and in order to meet the aforementioned goals, *A Time for Science* works:

- To recruit, coordinate, and facilitate the skills and talents of capable and willing individuals throughout various public and private organizations;
- To cooperatively work with Pitt County Soil and Water Conservation District and the Bray Hollow Conservation Easement;
- To harness the resources of other available private and public community assets; and
- To provide location, facilities, resources and a supportive environment with which to enable participants in the programs and activities it offers to develop curiosity, logical thinking and creative problem-solving skills while being fully ***engaged in*** and ***experiencing*** both environmental awareness and the scientific process.

Why an Environmental Learning Center?

Consider a few salient statistics and findings about youth and the environment.

1.3% - Average yearly decline in national park visits in America.

25% - Total decline since 1987. *Proceedings of the National Academies of Sciences*

50% - Decrease in proportion (from 16% to 8%) of children 9 – 12 who spend time in such outside activities as hiking, walking, fishing, beach play, gardening (organized sports not included) from 1997 – 2003. This was accompanied by an increase in computer play time for all children as well as in time spent on television and video games. *Hofferth, a family studies professor at the University of Maryland.*

6.5 - Number of hours per day children ages 8 – 18 spend on TV, electronic games, computers, music and other electronic media (with many electronically multitasking). *Kaiser Family Foundation.*

16% - Percent of U.S. children who are obese

- 9** - Number, *in millions*, of U.S. children ages 6 – 16 who are overweight (usually growing into overweight adults with increased risk of heart disease, diabetes, asthma, and others). *Federal Health Statistics.*

Substantial justification for the need for a nature and environmental education center can be found in the observations and arguments of Richard Louv, author of *Last Child in the Woods: Saving our Children from Nature Deficit Disorder and his interviews*. A variety of excerpts from his book, articles about it, and from his numerous interviews are quite instructive.

“This book explores the increasing divide between the young and the natural world, and the environmental, social, psychological, and spiritual implications of that change. It also describes the accumulating research that reveals the necessity of contact with nature for healthy child—and adult—development.”

“For a new generation, nature is more abstraction than reality. Increasingly, nature is something to watch, to consume, to wear—to ignore. A recent television ad depicts a four-wheel-drive SUV racing along a breathtakingly beautiful mountain stream—while in the backseat two children watch a movie on a flip-down video screen, oblivious to the landscape and water beyond the windows.”

“Yet, at the very moment that the bond is breaking between the young and the natural world, a growing body of research links our mental, physical, and spiritual health directly to our association with nature—in positive ways. Several of these studies suggest that thoughtful exposure of youngsters to nature can even be a powerful form of therapy for attention-deficit disorders and other maladies. As one scientist puts it, we can now assume that just as children need good nutrition and adequate sleep, they may very well need contact with nature.”

“... much of the evidence points to benefits. We see increased self-confidence, better [body image](#), and cognitive benefits. Kids who spend more time outdoors tend to do better on testing; they do better on science; they tend to play more cooperatively.”

“Organized sports are a help, but children need unstructured time to explore, Mr. Louv says. And the kids who do play on a team usually don't do it year-round. Cultural pressures and the sheer number of gadgets available also make it more difficult for children to just go outside.”

As for Pitt County in particular, consider this: within the mission and responsibilities of the Pitt County Soil and Water Conservation District, a strong environmental education program is provided to the citizens of Pitt County to inform all ages of the need for protecting our natural resources. Environmental Field Days, contests, and other activities are sponsored throughout the year for students within the county. One of the most valued and successful of these is the signature, international *Envirothon* program for middle- and high-school students. However until the recent working relationship had been established between the Pitt County Environmental Education Center and the Bray Hollow Conservation Easement, Pitt County had no location to which participants in any of their environmental education programs could be brought in order to experience real-world settings or to participate in hands-on learning for forest, aquatic or other ecological and environmental issues. Such field activities necessitated trips to either Weyerhaeuser's Cool Spring Environmental Education Center near New Bern, NC or to Goose Creek State Park beyond Washington, NC.

Although relatively small in comparison to Cool Spring, the combination of County lands and Bray Hollow lands offers a greater variety of ecological and wild-life habitats within a short walking distance than those offered by the larger facilities; and it does not require hours of travel time for Pitt County residents. Additionally, in association with *A Time for Science* Learning Center added support for *Envirothon* and for scientific and technical research projects are afforded to students interested in environmental topics.

I hear and I forget, I see and I remember, I do and I understand.

(Confucius)

Why a Science Learning Center based on a “Learn-by-Doing” Approach?

Consider a few statistics concerning the status of science education.

38% - Percent of PhDs in the U.S. scientific and technology workforce in 2000 that were foreign born. *National Science Board, 2004*

86% - Percent of U.S. voters in a recent survey who believed that the number of workers with a background in science and mathematics must be increased to compete in the global economy. *Business Roundtable, 2006*

25% - Percent of N.C. 2005 fourth graders *proficient* in science and

35% - Percent *below basic*. *National Assessment of Educational Progress, 2005*

22% - Percent of N.C. 2005 eighth graders *proficient* in science and

47% - Percent *below basic*. *National Assessment of Educational Progress, 2005.*

7.1% - Average percent of class time during the week in K-8 education spent on elementary science instruction for 2003 – 2004

9.2% - Same statistic for 1993 – 1994. *National Science Board Commission’s study “Still at Risk: A National Failure to Implement”*

14th - Science proficiency ranking in 1999 for American 15-year olds among 32 developed countries.

19th - Ranking in 2003 among 29 countries.

25% - Percent of N.C. high school students who take an upper-level science course in high school. *Council of Chief State School Officers, 2005*

35% - Percent of new elementary school teachers who say they rely more on their high school science for what they teach than on what they learned in college. *Bayer, 2004*

93% - Percent of fifth through ninth graders taught physical science by teachers with neither a major nor a certification in any of the physical sciences (chemistry, geology, general science, or physics). *National center for Education Statistics, 2004.*

3 - The number of physics teachers produced by the University of North Carolina between 2002 and 2006. *University of North Carolina, 2006*

In its most recent report on science education, The International Mathematical and Science Study (TIMSS) places the status of the United States below the medium internationally, North Carolina below the median nationally, and the Eastern Region below the state-wide median.

Since the 1983 publication of the landmark report “A Nation at Risk” describing and documenting the crisis in U.S. science education, a proliferation of surveys, studies, reports and programs have been published by virtually all of the major scientific and technology societies, by business and industrial groups, and by major academic institutions describing what has been referred to most simply as “hands-on, inquiry- or research- based” processes (i.e., **DOING SCIENCE** rather than learning about science) as the most effective means of achieving the science educational objectives set forth by these same organizations. Though seldom tested and hence rarely used nearly every state includes something to this effect in their “standard course of studies.”

From all of the research and programs to come out of the past quarter century **educators** in fact **DO KNOW WHAT WORKS**. But in spite of everything that has been learned, developed, and promulgated, because of a variety of challenges (not the least of which is the proliferation of and emphasis on standardized tests – which rely almost exclusively on MEMORIZATION but are, nevertheless, still used to assess both the basic “knowledge and understanding” of children, the “ability” of teachers, the “quality” of schools and, often, the “fate” of both principals and superintendents) and due to seemingly perpetually “limited resources,” precious few teachers, only the occasional school, and only the most courageous school systems have taken the steps or made the investments in time and long-term effort needed to turn things around. Consequently, as the statistics above demonstrate, the crisis has merely gotten worse. And this is especially true for Eastern North Carolina.

No better supporting evidence for these stated propositions is available than the information presented at and the final report from the *2007 North Carolina Science Summit, K-8 Science Education: Elements That Matter*, presented by James B. Hunt, Jr. *Institute for Educational Leadership and Policy*. The following excerpts have been taken directly from this source (However, the emphases in bold print are those of the author.) and clearly make the case for support of *A Time for Science*).

“In my opinion I can’t think of anything we need to change more than science education. We’re living in a world today where this has become absolutely crucial.” *Governor James B. Hunt, Jr.*

“Today’s student **must be taught effective reasoning, creative thinking, decision making and problem solving** in the early grades.” *Judith Rizzo, Ex Dir. And CEO, James B. Hunt, Jr. Institute for Educational Leadership and Policy*

“In the 1960s we won the race to the Moon, and later prevailed in the Cold War. Now, our nation must run in another race: a race to educate our youngest students in a way that ensures a meaningful contribution to a scientifically-driven society throughout their lives. It is a **race towards scientific literacy**.”

“In today’s world, we are challenged by issues that are increasingly complex: global warming, alternative energy, and genetic engineering. Today’s citizens need ever-increasing knowledge - scientific literacy - to understand the impact of these on their daily lives and to make informed decisions. We need to prepare our students to tackle issues such as these by exposing them to learning experiences beginning at an early age. Children **need to not only understand basic science, but also to apply its principles to everyday experiences. We do our children a disservice by providing anything less.**”

“**Students in today’s classrooms require more enriching and stimulating activity; more than planting a bean in a cup and watching it grow, or viewing an eclipse through a pinhole in a box.**”

“Despite the need for greater knowledge in and understanding of science and scientific processes, today’s landscape shows our children are not getting a solid science education. Science proficiency is poor in elementary school, and actually declines the longer a student stays in school. **According to the 2005 National Assessment of Educational Progress (NAEP), 34 percent of fourth graders are below the basic level of science proficiency. In eighth grade, that number increases to 43 percent, and rises to 48 percent by 12th grade. In North Carolina, students’ science proficiency is below the national average. Fourth-grade students ranked just below the national average for NAEP science scores, but eighth graders were in the bottom third of all states. ... The statistics are even worse among disadvantaged students.**”

“The **traditional model of science instruction focuses on memorizing scientific facts**. This establishes only a minimal foundation for mastering science and limits students’ ability to think

about and interact with their environment. This **traditional approach is no longer adequate** for preparing students for today's world. In contrast, **good science education stimulates a child's natural curiosity through hands-on experiences. It helps children look for reasoned explanation, use observations as evidence, and understand how to listen to scientific information. Good science education educates students on how to think, not what to think.**"

"Effective science education uses analogy and metaphor to help students understand abstract concepts so they can translate them into real life situations. The National Science Resources Center (NSRC) has documented recent Harvard University and MIT graduates who could not explain how a tree begins life as a tiny seed and gains the mass and weight necessary to become a full-grown tree. While all of them probably studied photosynthesis at some point in their education, none of them could connect that concept with the tree. **This is an example of how the "memorization method" does not effectively yield students who are able to problem-solve.**"

"Effective science teaching uses hands-on experience and a defined learning process to create a deeper level of understanding. According to the NSRC, such methods encourage students to:

- share their preconceptions about the topic, which is critical to creating conceptual change;
- explore the concept in-depth in a risk-free environment;
- reflect on what they have learned - sharing ideas and persuading others to understand the conclusions they have drawn; and
- demonstrate their understanding by applying what they have learned to a new situation and formulating new questions to investigate."

"In short, effective science teaching helps children think logically and solve problems - including multiple activities that build upon each other to provide conceptual development. It teaches students how to make observations that apply learning to other real-life situations and to better understand the world in which we live."

"Inquiry-based instruction is emerging as a hallmark of effective science education. For the purposes of this report, the inquiry-centered method of instruction is defined as a teacher guided instructional approach that engages students in investigating real world questions within a broad thematic framework. It complements traditional instruction by deepening students' learning and tying it to broader concepts. **Students acquire and analyze information, develop and support hypotheses, provide solutions, and demonstrate their thinking and learning in tangible ways."**

"The benefits of an inquiry-based model of science instruction reverberate across academic subject areas. **Strong connections have been made between hands-on, inquiry-based science education and student literacy.** ... In a broader sense, inquiry-based science education also teaches children important life skills as well, such as critical thinking, finding order within chaos, and believing that practice leads to improvement. Feeling confident that you have control over what happens in your life, and that your effort does matter, shapes what you are willing to try and ultimately achieve."

"Initiated in 1996 by Nobel Laureate Georges Charpak, *La Main à la Pâte* (literally "Hand in the Dough") is a program of the French Academy of Sciences that uses inquiry-based instruction to teach science and expose children to the culture of science beginning in the primary grades. ... Because of the success in France, the *La Main à la Pâte* program is being replicated internationally, with similar national initiatives in countries such as China, Columbia and Chile. ... China's **Learning by Doing program has helped Chinese students rank among the highest achievers in science proficiency.**"

“Overall, studies show that those countries which outperform the U.S. in science education tend to make it a national priority, spend energy and money to ensure high-quality curriculum for every school, and align that curriculum to clearly articulated national goals.”

Why A Time for Science?

A Time for Science is a one-of-a-kind endeavor within Pitt County and its immediately surrounding counties in that its primary purpose is on the “**doing of science.**” It is dedicated to advancing science literacy and competency as well as environmental awareness and appreciation by focusing on active participation in the scientific process, and by encouraging and supporting student participation in science, engineering, and math competitions. In addition to its primary objective and signature program of providing a supportive environment for the conduct of student research projects through sponsorship of age related Science/Math Clubs, *A Time for Science* also develops and presents other appropriate programs and activities that foster these objectives.

It should be pointed out that at annual State and national science competitions for middle and high school participants there is over \$10,000,000 worth of prizes in cash awards, scholarships, internships, international travel, assistance, etc. available to students. But it should likewise be pointed out that local and regional competitions are required qualifiers for entry at the State level and for that several years prior to 2008 there were either very few or no high school entries to the State competitions from this region.

Programs and activities at *A Time for Science* are developed and directed by scientists and award winning science educators who, each with decades of experience, are well versed in nationally and internationally recognized, hands-on, inquiry-based programs such as **FAST** (Foundational Approaches to Science Teaching), **GLOBE** (Global Learning and Observations to Benefit the Environment), **NASA** (National Aeronautics and Space Administration), **Sci-Link** (Linking Scientists, Teachers & Students), **ENVIROTHON**, and others. In order to adapt to frequent changes in the goals and objectives of state and local course requirements, these educators likewise have experience with and facility for curriculum development, and the creation of activities and programs that fit the pattern and aims of these acclaimed techniques. Over the years these educators, collectively, have supervised, advised and/or directed hundreds of successful student research projects. Together the founders and advisors to this endeavor also have an established and considerable network of colleagues, associates, and friends suitably qualified to act as advisors for student science, math, and technology projects and as volunteers for other Center activities.

Located adjacent to the County’s facilities in southern Pitt County, the Bray Hollow Conservation Easement is an integral part of and partner with the Pitt County Environmental Education Center. Together their contiguous lands offer a variety of ecological habitats for study, research **and enjoyment.** *A Time for Science* works in close association with the *Pitt County Environmental Education Center* and the *Bray Hollow Conservation Easement* in its presentation of environmental, ecological and earth science programs and activities. To see a video clip of what is available proceed to the following website and click on the image.

<http://www.ncsmt.org/newsletter.php?action=Detail&id=396&categoryid=3>

Primary References

Last Child in the Woods – Revised: Saving Our Children from Nature-Deficit Disorder. Richard Louv, Algonquin Books of Chapel Hill, 2008. 390 pp.

K-8 Science Education: Elements that Matter, A Report from the 2007 North Carolina Science Summit, James B. Hunt, Jr. Institute for Educational Leadership and Policy

Video clip from *North Carolina Science, Mathematics, and Technology Education Center*