Ocean Studies and Climate Change:
History, Science, and The Future ™

The National Classroom, Inc.
Building workable solutions to educational problems
of the 21st century ™
www.thenationalclassroom.com

Our perspective

As educators, our goals are to inspire the intellectual curiosity of children and adults, to build knowledge and analytic skills through innovative curriculum design, and to address topics that are critical for the successful lives of future generations. **Ocean Studies and Climate Change** is a huge topic that includes all of these challenges. It is an interwoven terrain of many areas of study new to most of our teachers and almost all of our students. We have identified five guiding principles that enable students, teachers, parents, and learners of all ages to engage in shared exploration of intellectual terrain that is both new and very important. We invite you to join this adventure.

Five principles

Our work is framed by the following principles.

1. **Teachers as learners.** On the topic of Ocean Studies and Climate Change, we are all learners, and that's a good thing. "It is virtually impossible to create and sustain over time the conditions for productive learning for students when they do not exist for teachers." (Seymour B. Sarason, *The Predictable Failure of Educational Reform,* 1993)

2. **We enter this terrain through many doors.** Second and third graders can begin by reading the many terrific books available about whales, dolphins, penguins, and polar bears. How is it that "killer whales" are classified as dolphins? Eighth graders can learn the use of mathematical models to predict future events by trying to build mathematical models of their own real-life events: local temperatures? baseball players' batting averages? daily attendance at their school? Here is a bigger, even harder, topic: How do we deepen our understanding of waves, from tsunamis to sound waves to microwaves. What is a wave?

3. **The right to know.** Our students have the right to learn all they need to know in order to live successfully on the planet we will bequeath to them. This planet is the environment on which all life depends, and it is changing. In some ways, it is changing swiftly and dramatically; the extent of future change is unknown. A shared search to understand, love, and protect Mother Earth is something we owe to our children, their children, and to all future generations.

4. **Open-ended inquiry.** We don't know the end point of this project, how we'll get there, or the pace of our progress. However, that must not stop us. This inquiry is wide-ranging and open-ended. See Principles # 2 and # 3.

5. **Correct English and mathematics are essential tools.** In the United States (and increasingly throughout the world) fluent speaking and writing of correct Standard English and the accurate use of mathematics are essential tools for intellectual work. Correct use of Standard English and mathematics by our students are necessary for their ideas and communications to be understood and taken seriously by others.

How do we begin this work? Study groups

We propose to begin by organizing our work into Study Groups. Study Groups can offer a range of flexible formats that invite adults and young people – in different configurations, with different interests – to begin learning about the specific topic or phenomenon they find most interesting, relevant, or important. A teacher with a small group of interested students, a whole classroom, or a whole school, adults who work professionally on these topics collaborating with interested amateurs, a home-schooling family looking for a new intellectual adventure: in any of these configurations you can create a Study Group, choosing the topics and formats that work best for you. This terrain is vast. We can enter through many doors and, by doing the work, discover how our interests and findings converge. Be intellectually adventurous. Use this opportunity to experience the joy of exploring new subjects, encountering new ideas, learning new skills. See below for some of the possibilities.

We will be glad to help. Your interests, the age and competencies of your participants, the setting in which you live or work, or the learning standards you must address will help define your explorations of Ocean Studies and Climate Change. What you begin to learn will help guide your next questions and further exploration. Our goal is to spend quality time with groups of learners (adults and students) who are ready to enter this terrain through a topic of their choice.

In our conversations with oceanographic scientists, school administrators, teachers, and students, and with activists developing sustainable energy projects – a common theme has emerged. While official reports, websites, and museum exhibits report the exciting findings of researchers – without exception, every professional we've contacted has been eager to connect their work in a deeper or more consistent way with real learners, in real schools. Similarly, many teachers desire those connections, but aren't sure how to initiate them. As a result, the engagement of students, teachers, and classrooms with this intellectual terrain is widely desired, but still mostly haphazard and limited. Moreover, the task of effectively integrating these studies with student mastery of the new Common Core English and Math standards and Next Generation Science standards is just beginning.

Jerome Bruner, the pioneering cognitive scientist, almost 50 years ago described the work of curriculum development in his book *Toward a Theory of Instruction* (1966):

> A theory of instruction must specify the ways in which a body of knowledge can be structured so that it can be most readily grasped by a learner.

Let us begin that work on this terrain. Ocean Studies and Climate Change is a "body of knowledge" whose extent and importance are expanding daily. A generous grant allows this project to be both rigorous and adventurous. Now we are looking for learners, teachers, and interested citizens ready to form Study Groups, to step out (swim out?) into this terrain, to seek emerging knowledge in ways that work for you – and to chart a path that can be joined and expanded by other interested learners over time.

Some initial ideas

What are the doors that open onto Ocean Studies and Climate Change?

Animal studies
Students in the early elementary grades can start with whale and dolphin books and move on to the books about manatees, jellyfish, and sharks. There are many wonderful books available at any public library. Used copies of excellent children's books about all manner of ocean animals can be purchased for a dollar or two on Amazon.com. Hand out the books in an elementary classroom and let the students read. That'll get you started.

The fifth IPCC report
The International Panel on Climate Change (IPCC), in its fifth Assessment Report, announced the near-certainty that global warming caused by human activity is occurring, provided the evidence for this conclusion, and called for world-wide limits on the emission of greenhouse gases. How do students learn to read and understand such reports? See the next section.

Common Core English and Math Standards, Next Generation Science Standards
The widely-adopted Common Core standards and soon-to-be-adopted Next Generation Science Standards define skills which students across most of our nation must learn at each grade level. Ocean Studies and Climate Change projects can address these standards directly. The Common Core English standards open with this overview of what is needed:

- [Students should] habitually perform the critical reading necessary to pick carefully through the staggering amount of information available today in print and digitally. They [must] actively seek the wide, deep, and thoughtful engagement with high-quality literary and informational text that builds knowledge, enlarges experience, and broadens worldviews. They [should] reflexively demonstrate the cogent reasoning and use of evidence that is essential to both private deliberation and responsible citizenship in a democratic republic. In short, students who meet the [Common Core] Standards develop the skills in reading, writing, speaking and listening that are the foundation for any creative and purposeful expression in language. (Common Core State Standards for ELA and Literacy in History/Social Studies, Science, and Technical Subjects, p. 3)

Beginning as early as kindergarten, the Common Core standards in English ask students to perform such tasks as "identifying the reasons an author gives to support points in a text" (Standard RI.K.8) and "noting basic similarities in and differences between two texts on the same topic" (RI.K.9). By fifth grade, students are expected to "quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text" (RI.5.1); "explain the relationships or interactions between two or more individual, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text" (RI.5.3); and "analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent" (RI.5.6).

The Next Generation Science Standards (NGSS) call for students, beginning in kindergarten, to formulate answers to such questions as: Where do animals live and why do they live there? What is the weather like today and how it is different from yesterday? What are some ways plants and animals meet their needs so that they can survive and grow? How does land change and what are some things that cause it to change? What are the different kinds of land and bodies of water? How are plants, animals, and environments of the past similar or different from current plants, animals, and environments? What happens to organisms when their environment changes? What are waves and what are some things they can do? How can water, ice, wind, and vegetation change the land? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem? (NGSS, p. 4-7)

NGSS expectations call for students to demonstrate proficiency in: asking questions, developing and using models, planning and carrying out investigations, obtaining,

evaluating and communicating information, analyzing and interpreting data, constructing explanations and designing solutions, and engaging in argument from evidence.

The grade 5 expectations include the following Disciplinary Core Ideas, STEM practices, and Cross-cutting Concepts:

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model shows that gases are made from matter particles that are too small to see and are moving freely in space. [This] can explain many observations, including … the effects of air on larger particles or objects. (Disciplinary Core Idea: Standard 5-PS1-1)
- When two or more different substances are mixed, a new substance with different properties may be formed. (Disciplinary Core Idea: Standard 5-PS1-4)
- Modeling in grades 3-5 … progresses to building and revising simple models and using models to represent events and design solutions. [These] include investigations that control variables and provide evidence to support explanations or design solutions. (Science and Engineering Practices: Standard 5-PS1-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (Crosscutting Concept: Standard 5-PS1-4)

The Standards for Mathematical Practice in the Common Core expect all students to develop and use mathematical modeling: "Mathematically proficient students can apply the mathematics they know to solve problems, arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to solve a situation. In middle grades, a student might apply proportional reasoning to … analyze a problem in the community. By high school, a student might … use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose." (CCSS for Mathematics, p. 6)

There is no reason to believe that students can master these rich curriculum standards simply through endless "drill and kill" worksheets or by analyzing fictional scenarios which can't be tested against the real world. These Literacy, Math, and Science skills are for understanding the real world, in all its complexity. The work of Ocean Studies and Climate Change offers students the opportunity to learn and use these skills to address problems that are real, complex, and very important.

Tough decisions

For example, students on Cape Cod, in Gloucester, MA – or anywhere – might gain

mastery of the skills described above by wading into the complex dilemmas framed by the following factors:

- Federal laws and strict enforcement now protect ocean fisheries off the coast of New England by dramatically limiting what commercial fishermen are allowed to catch and sell each day.
- Successful animal protection legislation decades ago (or is it global warming?) has led to a dramatic increase in the population of seals on the shores of Cape Cod. An estimated 10,000 or 15,000 grey seals off Cape Cod were the largest population seen in years. A fully-grown seal can eat up to 50 lbs. of haddock or bluefish *per day*. Are we limiting fishermen's chance of earning a living while the seals' voracious eating habits can deplete exactly the same fish stocks?
- The protection of seals is part of established federal laws protecting many endangered (or previously endangered) species. If we let the current U.S. Congress re-open that legislation, will the political dynamics in Washington undo decades of successful wildlife protection? Under the Endangered Species Act, a person cannot kill, shoot, hunt, pursue, harass, capture, or engage in other activities deemed harmful to the seals.
- BUT all those seals may attract lots of sharks. Sharks eat seals, sometimes attack humans, and don't read the Endangered Species Act. Will these changes in ocean animal populations make Cape Cod a place increasingly dangerous for beach-goers? Or will the tourists flock to Cape Cod to see the seals, maybe have the thrill of a shark sighting, buy lots of "Jaws" t-shirts, and boost the local economy?
- How does this human-animal-ocean-and-economic ecosystem fit together? What's the right thing to do? When those sharks arrive off Cape Cod – where were they living before? Research scientists are catching and tagging sharks with electronic transmitters to try to understand much that is currently unknown about the sharks' habitats and "lifestyle."

Wouldn't it be wonderful for a group of middle school or high school students (perhaps even elementary students) to research these topics and become true experts on the animal habitats, the data known and to-be-discovered, the views of local folks and visitors, the laws, policy choices, and civic processes needed to address complex matters like these?

Visionary planning – the Netherlands

The Dutch have been living below sea level for thousands of years and they are far ahead of other countries in preparing for new realities and challenges due to climate change. Many of us, as children, learned the story of the little Dutch boy who saved his town by putting his finger in a hole in the dike and holding back the sea. Holland is one of the most densely populated nations on earth and 2/3 of its land is vulnerable to flooding – but their visionary planning proposes an end to their war to hold back the sea. Instead, they are

creating an “amphibious nation.” They have new buildings designed to rest on dry land most of the time, but to float during a flood. Sewer connections and electrical wires can unwind and extend so these buildings are not torn from their supporting infrastructure. Cities and rural areas are being landscaped to embrace future storm surges and safely release sea water back into the ocean. A huge “Sand Engine” is using the natural sand-moving processes of the North Sea to create new barrier islands to protect coastline areas. Our Ocean Studies and Climate Change project has begun conversations with Tracy Metz, a Dutch-American journalist whose book *Sweet and Salt: Water and the Dutch* helps us wrap our brains around a vision of the future being invented and built by a little country with a lot of experience at this sort of thing.

Even more ambitious ventures will be presented at the second “Delta Cities in Times of Climate Change” conference scheduled for September 24 – 26, 2014 in Rotterdam. This conference will bring together scientists, planners, and citizens from innovative coastal cities including Rotterdam, Copenhagen, London, Melbourne, Hong Kong, Ho Chi Minh City, New York City, New Orleans (and more) to share their best ideas and initiatives related to Risk Assessment, Green Adaptation / Building With Nature (the Sand Engine is a Building With Nature project), Food Security and the Rural Landscape, Government and Finance, and – nearest to our own focus: Awareness, Capacity Building, and Resilience. Let’s call that last area “Education.”

Sustainable energy – Solar power

An exploration of renewable energy in Massachusetts might begin with a Study Group learning about the Plymouth public school system’s recently-announced project to build, on 23 acres of land (an area the size of 18 football fields), solar panels to meet 80% of the district’s energy needs in future years. This project has the possibility of saving millions of dollars each year and reducing the school district’s carbon footprint dramatically. How did this small town develop such an ambitious plan? How are they financing it? How did they reach agreement for the large amount of land – not in Plymouth, but in a neighboring town – to be dedicated to this use? Is the plan working? To its full potential? Could and should other government or private organizations make such a major shift, now, to renewable energy?

Sustainable energy – “Cow Power”

There are dairy farms in Vermont and elsewhere which now generate, from the farm’s own cow poop, sufficient fuel and electrical power to meet all their energy needs – electric lights, refrigeration, milking machines, even heating the barns in winter and ventilating them in summer – and, in addition, to sell extra electricity back to the public grid. One large farm in Fair Oaks, Indiana has recently announced they can do all this and fuel their delivery trucks as well with the methane extracted from the farm’s own cow poop! As long as they are milking cows, they explain, they can meet all of the energy needs of a large agricultural enterprise.

In addition, the “cow power” process produces very clean, nutrient-rich organic fertilizer while reducing dramatically the pollution of local streams and rivers due to agricultural run-off.

How does Cow Power work? What is in cow poop that makes fuel or electricity? What is an anaerobic digestor, the machine which carries out this transformation? What does the machine do? How does it function? What is methane? When is it a powerful greenhouse gas (very bad for the environment) and when is it a terrific fuel to run the farm (very good for the environment)?

What is the science of all this? The engineering? The biology? The economics? The public policy decisions? There’s a lot to be learned about Cow Power – all of it aligned with Common Core and Next Generation standards.

Nuclear power, hydroelectric power, wind power

The Vermont Yankee nuclear power plant is being shut down because it can’t compete economically with the low-cost natural gas being produced by fracking. What is natural gas? Isn’t it, also, methane? Does the shut-down of Vermont Yankee improve our safety or threaten it? How do you shut down a nuclear power plant? What happens to the dangerous nuclear waste? Where do we store it for thousands of years? What have we learned from the disaster at Fukushima, Japan?

Hydroelectric power comes from dams on rivers: Is that good for “sustainable energy,” but bad for fish and other wildlife? Do we have to cut down beautiful forests to build power lines that will bring Canadian hydroelectric power (They have lots of it!) into New England? How does a river make electricity? Is this good for the environment, bad for the environment, or some complex mixture of the two?

Wind power? Why are some people who live near the turbines so opposed to this clean, renewable energy? How can we store and transport wind energy, which is often created far away from, and at different times than, our use of that electricity?

Different places, different challenges

Vermonters probably don’t have to worry so much about rising ocean levels or increasing shark populations. But Hurricane Irene, which hit Vermont hard, may have demonstrated that the roads and trails that ski resorts have cut into mountain forests can become torrential rivers bringing flood waters into towns at the foot of the trails. If global warming increases the frequency or intensity of hurricanes, will that be a problem for rural communities as well as coastal cities? What are the unique challenges that your community will face?

Visionary planning – New York City

Hurricane Sandy devastated East Coast cities and coastal communities. Afterward, the City of New York completed a detailed report to analyze what it needs to do to face major storms of the future more successfully. The report covers the full range of New York’s

vulnerabilities, from hospitals to transportation to liquid fuels and water waste, from the Bronx to Lower Manhattan to Staten Island. The plan proposes almost $ 20 billion of investments to make New York a "stronger, more resilient city" and outlines funding sources already identified to meet 3/4 of the proposed cost. It's an impressive report. How're we doing for Hoboken and Jersey City?

Colleagues and partners

We have key topics to study and potential partners to enrich the process. Did we mention the Roseway, a wooden schooner first launched in 1925, now fully restored and operated by the World Ocean School of Camden, Maine. The Roseway takes urban students and young people from across the planet out to sea to learn sailing, navigation, history, science, math – and how to work together in a setting where everyone's well-being depends on cooperation. We've had additional exploratory conversations with New England Aquarium, the Ocean Exploration Trust at the University of Rhode Island, educators in charter, private, and public schools, and lots more folks who have expressed interest in our work. Collaborative projects with teachers at the Pierce and Edward Devotion public schools in Brookline, MA, the Warren-Prescott, Hugh Roe O'Donnell, and Dante Alighieri public schools in Boston, and the Edward Brooke Charter School – Mattapan have launched our project. The fiscal sponsor for our initial funding was the Boston Educational Development Foundation (BEDF) and is currently Biodiversity for a Livable Climate. Each is a federally-approved 501 (c) (3) non-profit tax-exempt organization.

Deliverables?

What's the final product? Ask us about the Michael J. Perkins School's book, "Why Do We Celebrate Evacuation Day?" It was written by students and teachers at a public elementary school located inside the Old Colony housing project in South Boston. It demonstrates how children can become experts on an important topic which still baffles most Boston-area adults. The students have learned the power of developing their knowledge and putting it "out there" in the world. The book can be purchased on Amazon.com, at the Perkins School, or from The National Classroom, Inc. (contact information given below).

Ask your friends in Boston if they can explain to you why we celebrate Evacuation Day on March 17. Some will say it's only a sneaky way to close Boston's schools and government offices on St. Patrick's Day (which is also March 17). But that's not true. Evacuation Day is a real holiday, celebrating a fascinating event from American history. It was George Washington's first victory as leader of the colonial army, ending the British occupation of Boston – and it was accomplished with no bloodshed. The holiday was widely celebrated long before the wave of Irish immigrants arrived in Boston in after 1848. Ask your adult friends in Boston to explain Evacuation Day to you. Then visualize the power of a six year

old explaining the holiday's origins – with all the fascinating details – to an uninformed adult. At the Michael J. Perkins School, every student every year gets to experience what it feels like to be smart. It's a great feeling.

Are there Massachusetts students who can help us untangle the protection of fisheries, the proliferation of seals, and a possible shark problem on Cape Cod? Are there Vermont kids and teachers who can explain to us the science of Cow Power? Are there students and educators ready to wade into the new IPCC report on Climate Change or New York's massive plan to be ready for another Hurricane Sandy-level event? Can they write the next book to explain these things to the rest of us? Imagine the power of the collective knowledge that will emerge and be shared.

We're serious about students' right to know and to communicate what they know with the world. We believe our students deserve access to the knowledge and skills they will need to live successfully on this planet – and to feel empowered by the process. We're ready to join with you and young people in a shared search to understand, love, and protect Mother Earth – and ourselves! – in an era of climate change, educational change, and political change worldwide.

> "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." (Anthropologist Margaret Mead)
>
> It's about "taking the obvious seriously." (Psychologist Seymour B. Sarason)

You can enter this terrain through any of many doors.
Pick your own and join with us.

We're in it for the long haul.

We have a grant which enables our small organization to be engaged in this work for the next four or five years. We're committed to this work for the next two or three generations. We want to expand children's intellectual curiosity, knowledge, and analytic skills, as well as our own. We want adults and children to learn together and to share what they know. We want our work to be enjoyable, empowering, and true.

National Classroom t-shirts (available soon) will read:

This is our only planet.

Understand it.

Love it.

Save it.

We're looking for intellectually hungry partners: learners, teachers, students, classrooms, schools, professors, civic organizations and engaged citizens ready to join with us to create new educational adventures – to understand, love, and save the only planet we've got. We invite you to join us.

Organization profile

The National Classroom, Inc. is a small consulting firm dedicated to "building workable solutions to educational problems of the 21st century." ™ We understand the hopes and visions that teachers, children, and parents have – as well as the pressures and constraints that make it difficult to turn visionary dreams into classroom realities. We work with teachers who wish to inspire and nourish the intellectual curiosity of their students, themselves, and the larger communities of which they are a part. We believe that what is, these days, often referred to merely as "content knowledge" or "background knowledge" – learning about animals, people, oceans, machines, mathematics, history, poetry, baseball, our planet, and the future – in fact provides the driving motive for intellectual endeavor. We open multiple doors into important terrain with instructional plans, materials, lessons, curriculum maps, partnerships, and real-life adventures. We help children and adults master the new Common Core Standards in English and Math, the Next Generation Science Standards, and important topics worth studying. We invite teachers, students, parents, administrators and learners of all ages to join us.

Honor the past. Build the future. ™

Project leadership

Barney Brawer, president of The National Classroom, Inc., is a former classroom teacher and school principal. He has taught at the elementary and high school levels in New Haven, CT and Providence, RI and served as principal of elementary and K-8 public schools in Franklin, MA, Cambridge, MA, Putney, VT, and the Boston Public Schools for 14 years. He was principal of the Michael J. Perkins School, K-5, in South Boston from 2005 – 2013. In addition, he has been director of the Program for Educational Change Agents at Tufts University and co-director, with psychologist Carol Gilligan, of the Harvard Project on Boys' Development, Women's Psychology, and the Culture of Manhood. He is the senior author of *Defining and Requiring Academic Achievement: Carnegie Units, MCAS, and the Meaning of a High School Education.* That study, commissioned by the Massachusetts Education Reform Review Commission, is a comprehensive analysis of the origins and first five years of MCAS testing as an instrument of statewide education reform. A copy of the report is available on our website: *www.thenationalclassroom.com*

Katharine Scheid, project developer, is a tenured teacher in the Boston Public Schools, on leave to work with The National Classroom. She has been a classroom teacher at Orchard Gardens and Young Achievers K-8 schools, a consultant in classroom management at Young Achievers, a Teacher in Residence at Boston's Museum of Science, and a partner with the Center for Collaborative Education to analyze MCAS data and develop family study groups addressing standards-based deficits. She is certified to teach General Education (K-6), Special Education (K-8), and English as a Second Language.

Jim Swaim joined The National Classroom after a long and very distinguished career as a fourth grade teacher at the Edward Devotion School in Brookline, MA and more recently as a school administrator in the Brookline and Newton, MA public schools.

John O'Leary brings to this project his diverse experience as a rock and roll musician, corporate business consultant, and blogger (*www.businesslessonsfromrock.com*) with wide-ranging intellectual interests, knowledge, and skills.

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