

On Common Ground[®]

Strengthening Teaching through School-University Partnership

YALE-NEW HAVEN TEACHERS INSTITUTE[®]

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JASPER JOHNS, FLAG, 1954-55

Enacting a Nationally Significant Approach

Nothing we do in Congress is more important than ensuring our children have the tools and opportunities they need to succeed. For over 30 years, the Yale-New Haven Teachers Institute has demonstrated that partnerships between teachers and institutions of higher education are beneficial to the educators' professional development and, most importantly, lead to improved student achievement.

– Congresswoman Rosa L. DeLauro

High quality teacher professional development programs that focus on subject and pedagogy are proven methods for enhancing the effectiveness of a teacher in the classroom. The Yale-New Haven program has been incredibly successful. If this model is working let's give other teachers across the country the same opportunity. The need for effective teachers with deep content knowledge is most apparent and urgent in schools that enroll a high proportion of students from low-income families, exactly the schools that Teachers Institutes serve.

– Senator Joseph I. Lieberman

The Yale-New Haven Teachers Institute in Connecticut is an innovative model that can and should be used across the country to help teachers at schools in every community develop and hone their skills so that they and their schools can be successful. In order for students in every neighborhood to receive an education that will prepare them for the future, we must have teachers who are experts in their field and equipped with the best tools and strategies to educate our children.

– Senator Richard Blumenthal
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Editorial, Part I: On Enacting a Nationally Significant Approach

By Paul H. Fry

The African American "naïve" artist Horace Pippin (1888-1946) was born in West Chester, Pennsylvania and frequently painted scenes recalling his childhood, like the West Chester Courthouse depicted here. Having lost the normal use of his right arm to a sniper bullet in the First World War, Pippin took up painting in the twenties as therapy for the arm, guiding it with his left hand as he painted. Overcoming this considerable impediment, he enjoyed a well-deserved modest success as an artist, having attracted the attention of Romare Bearden among others, especially over the last decade of his life.

It is tempting to consider the life and example of Pippin an allegory of the present state of public education, and our hope for the modest success its hard-working and devoted teachers deserve with the odds building against them. What strikes me about Pippin's painting of the courthouse is that it looks just as much a like a schoolhouse, even in detail. The clock says 3:15, time for school to let out, and the child in front, who seems to be wearing a white carrying pouch, could either be hawking a news sheet recording some courtroom event or triumphantly holding aloft, for invisible parents or friends to see, an A on a homework assignment. If they "teach to the test" in that building, they have succeeded with this child, who may have benefited from the teacher's participation in some content-based, collegial and empowering precursor of — for example — the Teachers Institute of Philadelphia. As Delaware Secretary of Education Lillian Lowery points out in the remarks we have reprinted here, there is no incompatibility at all between responsiveness to standards and creative engagement with an Institute seminar.

A photograph reveals the allegorical figure on the pedestal, which has "Old Glory" engraved in large letters across the front, to

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HORACE PIPPIN, WEST CHESTER COURT HOUSE, 1940

be holding a gigantic flag billowing behind him. Of flags there will be more to say, but none of this is visible in Pippin's painting, where the figure seems to be enshrouded in a cape or cloak and to be raising an arm at an angle parallel to that of the child. As far as Pippin's handling of the silhouetted statue is concerned, it could be one of West Chester's three nineteenth-century members of the House of Representatives: the attorney Joseph Hemphill, the botanist and doctor William Darlington, or the attorney Washington Townsend. Let us hope their spirit will help to sponsor and pass into law the Teachers Institutes bill that is now before the House, supported by the fervent testimonials that the reader will find as the opening feature of this fourteenth issue of *On Common Ground*. The two commemorative plaques on the pedestal would seem to reflect the twofold connection Pippin wants to express in his painting: the link between law and learning that would confirm, in an ideal republic, the integrity of civic values.

The hope of our proposed legislation is to authorize the Institute model for every state in the Union, and Pippin's emphasis on the flag — above the building but firmly and copiously planted in the ground as well, almost as ubiquitous as the flag of Jasper Johns on our cover, especially if Pippin means the statue too to be the flag — seems to point the genius of place that inspires this locale in the direction of a national idea, the idea we hope to realize. The architect of the structure Pippin has painted, Thomas U. Walter, was also one of the architects of the Capitol building in Washington, D. C. But the location of Pippin's home town can also point toward something nearer to it: Delaware, not far off and across the river. New Castle County in Delaware is the home of the newest Teachers Institute, now completing its first year of seminars under the directorship of former teacher Ray Theilacker in cooperation with the University of Delaware under the stewardship of its President, Patrick Harker. This issue of our periodical

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Credits: Cover art: Jasper Johns/Licensed by VAGA, New York, NY. Collection of the Museum of Modern Art, New York. *Flag*. 1954-55 (dated on reverse 1954). Encaustic, oil, and collage on fabric mounted on plywood, three panels, 42 1/4 x 60 5/8" (107.3 x 153.8 cm). Gift of Philip Johnson in honor of Alfred H. Barr. Photo Credit: Digital Image The Museum of Modern Art/Licensed by SCALA / Art Resource, NY. **Page 2:** Horace Pippin, *West Chester Court House*. Date: 1940. Medium: Oil on canvas board. Size: 22 x 28 in. (55.9 x 71.1 cm.). Acc. No. 1979.1.3. Courtesy of the Pennsylvania Academy of the Fine Arts, Philadelphia. Bequest of David J. Grossman in honor of Mr. and Mrs. Charles S. Grossman and Mr. and Mrs. Meyer Speiser. **Page 8:** Jacob Lawrence, (1917-2000) © ARS, NY. *Builders in the City*, 1993. Gouache on paper, 19 x 28 1/2". Courtesy of SBC Communications, Inc. Location: Private Collection. Photo Credit: The Jacob and Gwendolyn Lawrence Foundation / Art Resource, NY. **Page 11:** Charles Sheeler, *Rolling Power*, 1939. Oil on canvas, 15 x 30 in.; 38.1 x 76.2 cm. Smith College Museum of Art Northampton, Massachusetts. Purchased with the Drayton Hillyer Fund SC 1940:18. **Page 12:** John Steuart Curry, 1897-1946, *Baptism in Kansas*, (1928). Oil on canvas, Overall (Sight): 39 1/2 x 49in. (100.3 x 124.5 cm). Whitney Museum of American Art, New York; gift of Gertrude Vanderbilt Whitney 31.159. Photograph by Geoffrey Clements. **Page 14:** Kerry James Marshall, (b. 1955) *Garden Party*, 2003-2007. Acrylic on paper mounted on canvas 108 x 120 inches (274.3 x 304.8 cm). Courtesy of the artist; Jack Shainman Gallery, New York. **Page 15:** Robert Indiana, American (b. 1928), *The Ten Stages Number Sculpture Reflected*, 1980, screenprint, 25 3/8 x 33 in. (image), 31 5/8 x 38 1/2 in. (sheet), 1988.276. Indianapolis Museum of Art, Gift of Mr. and Mrs. Fred Pacheco. **Page 16:** Mel Bochner, *Random Numbers (#1)*, 2002. Oil on paper, 20 x 15 inches. Copyright Mel Bochner. **Page 19:** Paolo Uccello, (1397-1475). *Saint George and the Dragon*, about 1470. Oil on canvas, 55.6 x 74.2 cm. Bought with a special grant and other contributions, 1959 (NG6294). Location: National Gallery, London, Great Britain Photo Credit: © National Gallery, London / Art Resource, NY. **Page 24:** *Portrait of Ellen Johnson*, 1976 (oil on canvas) by Alice Neel (1900-84) Allen Memorial Art Museum, Oberlin College, Ohio, USA / The Bridgeman Art Library Nationality / copyright status: American / in copyright until 2055. **Page 25:** M.C. Escher's "Symmetry Drawing E126" © 2011 The M.C. Escher Company-Holland. All rights reserved. **Page 30:** John White, *A Lande Crab*, 1585-1593. Watercolour over graphite, heightened with white (oxidised). Inv. PD 1906.0509.1.56. 9.13 x 10.9" (232 x 277 mm.). Location: British Museum, London, Great Britain. Photo Credit: © The Trustees of The British Museum / Art Resource, NY. **Page 31:** John Steuart Curry (American, 1897-1946). *Kansas Cornfield*, 1933. Oil on canvas, 60 3/8 x 38 1/2 in. Signed and dated lower left: JOHN STEUART CURRY/1933. The Wichita Art Museum, Wichita Kansas. Roland P. Murdock Collection, MI.39. **Page 34:** Unknown Photographer, Scene from "Othello" with Paul Robeson as Othello, Theatre Guild Production, Broadway, 1943-44. 1 negative; 5 x 7 inches or smaller. Library of Congress Prints and Photographs Division Washington, D.C. **Page 35:** Henry Perronet Briggs, (1791/93-1844) *Ira Frederick Aldridge* (c.1805-1867), as *Othello*. American Actor. Ca. 1830. Oil on canvas 121.9 x 101.6 cm. (48 x 40"). Location: National Portrait Gallery, Smithsonian Institution, Washington, DC, U.S.A. Photo Credit: National Portrait Gallery, Smithsonian Institution / Art Resource, NY. **Page 37:** Folio A 2011 49. Jacques Fabien Gautier d'Agoty (1710-1781), *plate II from Gautier d'Agoty's exposition anatomique des organes des sens*, Paris, Demonville, 1775, color mezzotint, Yale Center for British Art, Paul Mellon Collection.

The Teachers Institute Theory of Change

By Ellen E. Kisker

A theory of change is a succinct description of a program or approach and the mechanisms through which it is expected to improve its targeted outcomes. A theory of change, which may be referred to by other terms such as pathway of change, engine of change, blueprint, logic model or theory of action, identifies the important outcomes and indicates what intermediate outcomes to look for to ensure that the program is on the right path to improving targeted outcomes (Reisman & Gienapp 2004).

A theory of change is useful throughout all stages of a program's development. Initially, creating a theory of change can help stakeholders reach a common understanding of the program and how it will accomplish desired outcomes. Later, it becomes a tool for stakeholders to communicate with others about the program and its expected benefits. An explicit theory of change also provides a foundation for evaluating the program. It guides the development of research questions, informs evaluation design, and aids in interpreting and presenting evaluation results.

The Teachers Institute Theory of Change Maps Pathways to Teacher and Student Outcomes.

The Teachers Institute theory of change describes how program founders designed the Teachers Institutes to improve teaching and student learning. The Understandings and Procedures (Yale National Initiative 2007) provide a clear description of the essential features of the Teachers Institute approach. The theory of change extends this to focus on pathways to the expected benefits of following the Understandings and Procedures.

At its most basic, the theory of change illustrates how teacher and university faculty backgrounds, characteristics, and interests, as well as the leadership of the subset of Fellows who serve as seminar

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Coordinators, shape the implementation of Teachers Institute seminars (Figure 1). The immediate products of the seminars are the curriculum units created by participants and the professional recognition and faculty privileges at the university that participating teachers receive upon completion.

These immediate products are expected to lead to three strands of outcomes corresponding to teachers, students, and university faculty. For teachers, seminar participation is expected to result in increased content and pedagogical knowledge, which in turn is expected to improve the quality of their instruction. For students, teachers' increased knowledge and improved instruction are expected to lead to greater motivation to learn. The experiences of university faculty who lead seminars are expected to improve their own pedagogical skills, enhance their disposition to collaborate, and enhance their sense of being part of a learning community.

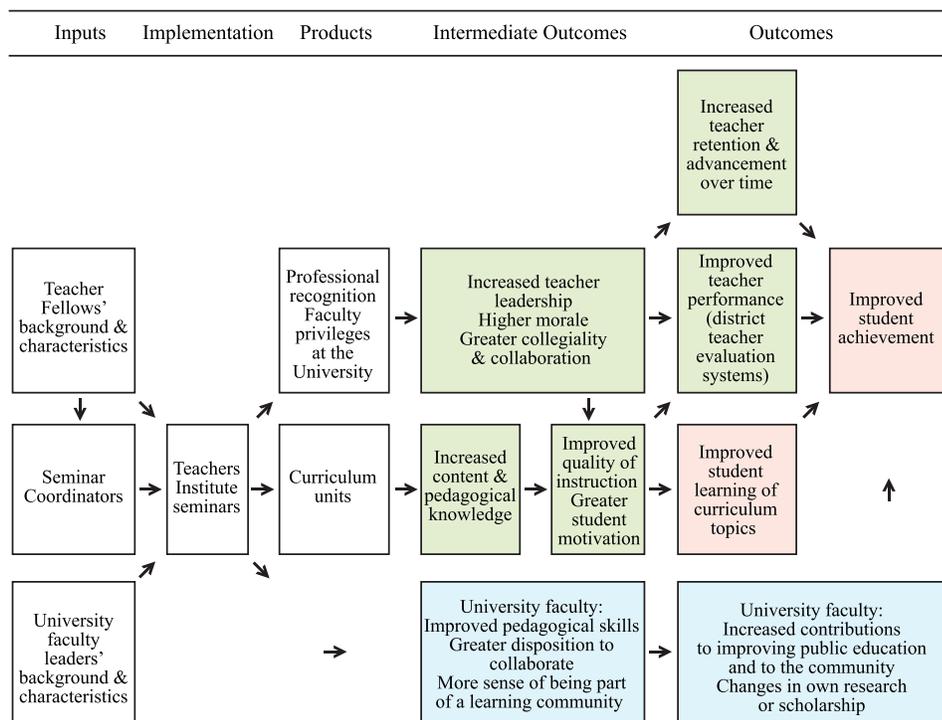
Ultimately, these intermediate outcomes

are expected to increase teacher retention and advancement and improve teachers' performance (as assessed in school district teacher evaluation systems), enhance student learning of curriculum topics, and enhance the contributions of university faculty to public education. All of these outcomes converge to support higher student achievement.

The Teachers Institute theory of change has a longitudinal dimension that is difficult to illustrate but is crucial for understanding the potential impact of Teachers Institutes over time. Although a relatively small number of teachers participate in seminars in a given year, over time a significant proportion of teachers will participate. Some teachers will participate in multiple years, which is expected to strengthen outcomes for those teachers and their students.

Higher teacher retention maximizes the benefits that compound over time. Teachers who remain teaching in the district continue to use Institute-developed

Figure 1
Theory of Change for Teachers Institutes



curriculum units and apply their enhanced knowledge and classroom practices in teaching future cohorts of students. Participating teachers who remain in their district are likely to grow into leadership roles and continue to foster collaboration, higher morale and collegiality among teachers.

Curriculum units are available for use by other teachers, further extending the potential effects of the Teachers Institute seminars across teachers and over time. In New Haven Public Schools, where the Yale-New Haven Teachers Institute serves approximately 50 teachers each year, simulations show that under reasonable assumptions about class sizes, teacher attrition, and returning Fellows, two-thirds of students in the school district at any time during a five-year period would be exposed to a curriculum unit taught by a Teachers Institute Fellow. In addition, approximately two-thirds of students enrolled at any time during the five-year period would be exposed to Institute-developed curriculum units taught by other teachers (Arnold 2010).

Research and Best Practices Support the Teachers Institute Theory of Change.

The Teachers Institute approach was developed more than 30 years ago, but it remains a state-of-the-art program. The theory of change is grounded in the founders' vision for the program, affirmed by participating teachers' reports about their experiences and the benefits of participating, and backed by research and experts' current understanding of best practices.

What Participating Teachers and Program-Sponsored Research Say

Outcomes research conducted by the Yale-New Haven Teachers Institute and the Yale National Initiative shows that participating teachers consistently rate their Institute experience as valuable and report experiencing key intermediate outcomes. Annual surveys have consistently shown that participating teachers rate the Institute programs higher than other professional

development programs in developing knowledge, skills, enthusiasm, high expectations of students, and capacities to motivate students (Smith 2004).

An analysis of surveys of Institute Fellows from 2003 to 2008 supports many of the pathways identified in the theory of change. The surveys show that teachers in all sites were motivated to participate in the Institute by the opportunity to develop materials to motivate their students, to develop curriculum fitted to their needs, to increase their

The Teachers Institute theory of change is grounded in the founders' vision, research, and practice.

content knowledge, and to exercise intellectual independence (Smith 2009). After participating in the Institute, teachers overwhelmingly agreed or strongly agreed that the seminars provided them with professionally useful new knowledge (87-94%) and that the seminars raised their expectations of their students (87-95%).

Periodic surveys of participating and non-participating teachers about their use of curriculum units developed by Teachers Institute Fellows show that virtually all Fellows go on to teach the units they prepared in their seminar (87% taught their units in 2 to 5 classes). Most teachers reported presenting their units in teacher-led discussions and stressed writing exercises and activities designed to strengthen speaking, listening, vocabulary, and reasoning skills. Two-thirds of all Fellows rated the units written by themselves or other Fellows as superior to all other types of curriculum they had used. Many reported that their units were written to be interdisciplinary and supported successful team teaching (Smith 2009).

Smith (2009) reports that Teachers

Institutes are influential in retaining existing teachers because participating teachers find the seminars stimulating and feel "respected and acknowledged as creative, caring educated colleagues." Quantitative analyses of data in New Haven confirm this. Of those teachers who had been Institute Fellows by the end of the 2000-2001 school year, 63% were still teaching in New Haven in 2004-2005, compared with 43% of other teachers. Fellows were almost twice as likely as non-Fellows to remain teaching in the district five years later, controlling for differences in race, sex, and years of teaching experience, a significant difference (Smith 2009).

The majority of participating teachers rate student attention, motivation, interest, and content mastery as higher during Institute-prepared curriculum units compared with other curriculum units (Smith 2009). A retrospective analysis of student achievement outcomes conducted during the same 5-year period, however, did not find significant effects of the Teachers Institutes on student achievement test scores or course grades. This was not unexpected, because the curriculum units were not aligned with achievement tests. Smith (2009) concluded that student outcomes data more closely tied to the goals of the Institute-prepared curriculum units, or more extensive and reliable data on student outcomes more generally, is required to demonstrate Institute impacts on students.

What Other Research Says

Strong causal research on the effectiveness of teacher professional development is still limited, but it provides evidence that teacher professional development can improve the intermediate and longer-term outcomes that the Teachers Institutes are designed to influence, especially when the professional development has features of the Teachers Institutes. Other correlational research also suggests that teacher professional development can improve intermediate and longer-term outcomes.

A number of studies suggest that
(continued)

Kisker: Theory of Change

professional development can increase teacher content knowledge. For example, Weiss and Miller (2006) identified six pretest/-post-test studies of mathematics professional development programs and found positive gains in content knowledge. Hill and Ball (2004) found that teachers participating in the California Professional Development Institutes in mathematics made significant gains in their mathematics content knowledge; institutes with greater duration and that focused on analysis, reasoning, and communication demonstrated larger gains. Of the 25 evaluation studies reviewed in Blank, de las Alas, and Smith (2008), 10 reported evidence of measurable effects on teacher content knowledge.

Research has also demonstrated that increased content knowledge can influence classroom practices. For example, Hill *et al.* (2008) examined associations between mathematical knowledge for teaching and the mathematical quality of instruction and found a significant, strong association between them. Supovitz and Turner (2000) found that teachers who felt more well-prepared to teach science topics in elementary school were more likely to engage in reform-based teaching practices and create a classroom culture of investigation.

Studies have also shown that teacher professional development programs can have a positive impact on classroom practices. Scher and O'Reilly (2009) conducted a meta-analysis of strong causal studies and found that the pooled effect size¹ of math and/or science professional development on teacher practice was .63 and highly significant. Porter *et al.* (2000) analyzed longitudinal data from science and mathematics teachers in 30 schools across 10 districts and found that professional development programs focused on specific, higher-order teaching strategies were associated with teachers' use of those strategies in the classroom, and the associations were even stronger when the professional development was reform-type, involved active

learning, was coherent, and involved collective participation.

Several studies point to the value of professional development that supports teachers in developing their own curriculum. Carpenter *et al.* (1989) evaluated a professional development program that made teachers aware of research findings, then supported them in developing curriculum units. The evaluation documented positive effects on teacher knowledge, improvements

The Teachers Institute approach encompasses many of these recommended best practices.

in observed teacher practices, and higher student achievement. McCutchen *et al.* (2002) provided an instructional institute for teachers focused on increasing teacher knowledge and supporting teachers in developing their own curriculum around what they learned. The evaluation documented positive effects on teacher knowledge and improvements in observed teaching practices.

Teacher professional development can have a positive impact on student attitudes and student perceptions. Scher and O'Reilly (2009) found significant pooled effect sizes of math and/or science professional development on student attitudes (.42) and student perceptions (.57).

The ultimate goal of teacher professional development is to increase student learning and achievement. Yoon *et al.* (2007) identified nine studies of professional development that met What Works Clearinghouse evidence standards. All nine studies employed workshops or summer institutes for elementary school teachers and focused on a range of content areas. Most reported effects on student achievement were positive; 8 were statistically significant, and 9 of the remaining 12 were substantively impor-

tant, with effect sizes of at least .25. The average effect size was .54. Studies of professional development that was more than 14 hours long showed positive effects while studies of professional development that was shorter did not. The meta-analysis conducted by Scher and O'Reilly (2009) also found positive effects on student math and science achievement, with pooled effect sizes ranging from .12 to .38. Subgroup analyses showed that impacts were concentrated in programs that took place over at least one academic year, focused on both content and pedagogy, and included both a workshop and coaching or another component. Blank, de las Alas, and Smith (2008) found that one third of the evaluation studies they reviewed reported measurable effects of teacher professional development in math and science.

What Experts Say

To help states and school districts making decisions about teacher learning and development, organizations providing technical assistance have synthesized research results and advice of experts to identify features and practices that make it more likely that a teacher professional development program will be effective. The National Comprehensive Center for Teacher Quality, for example, recently identified five features of high-quality professional development: (1) alignment with school goals, district standards and assessments, and other professional learning activities; (2) focus on core content and modeling of teaching strategies for the content; (3) inclusion of opportunities for active learning of new teaching strategies; (4) provision of opportunities for collaboration among teachers; and (5) inclusion of embedded follow-up and continuous feedback (Archibald *et al.* 2011).

The Teachers Institute approach encompasses many of these recommended best practices: (1) each Teachers Institute is aligned with school reform goals and is designed to support a district's strategic plan, and the curriculum unit each teacher develops is aligned with state and local standards;

¹ All effect sizes cited are in standard deviation units.

(2) Institute seminars deepen teachers' knowledge of core subjects and assist them in developing strategies to teach their own students what they have learned; (3) teachers are active learners in Institute seminars, receiving feedback from their peers and often trying out the units with their students as they prepare them; (4) the collegial exchange of ideas among school teachers and university faculty members lies at the very center of Institute seminars and is a tenet of the Institute approach; and (5) Institute seminars are of substantial duration, involving a minimum of 26 hours in session plus substantially more for meeting with seminar leaders, researching seminar topics, and writing curriculum units. Teachers Institutes are planned, implemented, and sustained by teachers. Each Institute seminar topic is suggested by teachers based on what they think will enrich their classroom instruction. Teachers recruit their colleagues to participate, and one teacher in each seminar plays a coordinating role to handle administrative details, help establish collegiality, and act as a resource for other teachers.

The Theory of Change Needs to Be Rigorously Tested Using a Strong Evaluation Design.

The Teachers Institute theory of change has a solid foundation in experience and research, but it is still a theory that needs more testing with research designed to assess the causal relationships in the theory. Evaluation of the Teachers Institute approach employing a strong causal research design to explore the pathways and measure the magnitude of Institute impacts on intermediate and longer-term outcomes is needed to confirm that the theory of change provides an accurate map from Institute participation to outcomes.

Planning for a strong evaluation of the Teachers Institute approach is under way. The Yale-New Haven Teachers Institute is undertaking a major redesign of its Management Information System (MIS) to better support program activities

and to capture data needed for research and evaluation. To the extent possible, the new MIS will be designed to accommodate variations among local Teachers Institutes and support their operations, as well as promote the collection of consistent data across locations.

Evaluation design activities are also under way. In the coming year, the Yale National Initiative will work with local Teachers Institute staff to prioritize research questions and identify Institutes where a strong evaluation is feasible. Building on past work to identify evaluation design options, the Initiative will develop a detailed evaluation design, sample design, and data collection and analysis plan for producing strong evidence of the effectiveness of the Teachers Institute approach. The Yale National Initiative will seek funding and contract with an independent evaluation firm to carry out the evaluation plan.

With stronger evaluation research based on the theory of change, school district decision-makers can have more confidence that implementing a local Teachers Institute will take them where they want to go and understand how it will do so. More broadly, lessons from the Teachers Institute evaluation will contribute to the learning and understanding of researchers and policymakers about how best to support teacher learning and development and thereby promote student learning and achievement.

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The New Castle County Teachers Institute

Building the Institute in Delaware

By Raymond F. Theilacker

In 2005, as a first-time Fellow of the Yale National Initiative, I had my sights set on retirement. After all, I had been a classroom teacher for almost thirty-five years and felt that there was not much else to explore in a profession that I had truly loved. And then I experienced the Institute. That year, it was my good fortune to work with Paul Fry in his seminar on poetry. In following years, Mary Miller, Steve Pitti, and again Paul Fry led seminars in which I wrote curricula that undoubtedly enabled me to do some of the most effective teaching of my career. I continued to participate as a National Fellow, then as the City Representative from New Castle County, then as Planning Director, and currently serve as Founding Director of the Delaware Teachers Institute in New Castle County (DTI). I could not have foreseen this involvement, but know full well why it happened. We hear it all the time when Fellows report that Institute seminars provide the *best* continuing academic training they've ever had. There are many reasons for this, but clearly it is what attracts teachers.

In Delaware, there were many factors that placed the value of DTI squarely before the institutional partners. In response to the teachers' exuberance was the strength of our superintendents' support. Individually and collectively, the chief school administrators found time and created forums for our growing number of National Fellows in which to advocate for the establishment of a Delaware Institute. There were presentations at school board meetings, invitational mes-

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JACOB LAWRENCE, *BUILDERS IN THE CITY*, 1993

sages on district Web sites, time allotted on professional development days, internal meetings with curriculum officers, and personal junkets to the Annual Conference, where they learned about efforts elsewhere and participated in team planning.

Fellows report that
Institute seminars provide
the *best* continuing
academic training
they've ever had.

On the University front, both teacher and administrator advocates came through the doors of the University's College of Education, whose staff were already familiar with the education landscape in Delaware, were pivotal in leading us to the College of Arts and Sciences administrators, and from thence to University administration, working with whom we

were able to describe our experiences and outline the potential benefits of partnership.

Finally, and concurrent with these developments, university faculty heeded invitations from teachers, school district and University administrators, and more recently, from their colleagues. As a result, a small chorus of Arts and Sciences professors became devoted to our establishment on campus, following three years of summer attendance at workshops offered during the Intensive seminars. Their enthusiasm and devotion back home — particularly in the planning phase — ultimately fueled the University president's endorsement and encouragement of DTI's formal establishment as a unit on campus. Today, we celebrate the commencement of our first four seminar offerings, and look forward to a permanent place in Delaware's educational landscape. Our path is well-worn by the steps of many who saw the value of what the Teachers Institute brings to the public school students of Delaware.

Fulfilling Our Commitment to Delawareans

By Patrick T. Harker

The University of Delaware has a profound obligation to the *people* of Delaware — for a few compelling reasons. UD is privately chartered, but state supported; it's Delaware's flagship institution of higher education; and it's among the country's earliest land-grant universities, a designation we take seriously. The Morrill Act of 1862 granted federally controlled land to states for the purpose of creating colleges that would undertake the practical and liberal education of the "industrial classes." In exchange for the land, states essentially signed on to two commitments: making higher education useful to their citizens, and ensuring that their citizens could access it.

And yet, nearly 150 years later, we cannot say this nation has fully resolved the problem of higher education access. Access faces two challenges: affordability and academic preparedness. While many federal and state programs have attempted to address the former — clearly doing a better job of it in flush economic times than in bleak — it's the latter challenge, academic preparedness, that we've spilled so much ink over in our quest to do it right.

Delaware has had its own issues with access. In a very small state — one that counted fewer than 8,500 public school seniors last year — UD enrolls far more nonresident students than it does Delawareans. Compounding this natural imbalance is something else, a readiness imbalance, not unusual in state-supported universities, where stiff competition for nonresident seats produces out-of-state pools heavily weighted toward high-achievers.

In a bid to raise in-state students' enrollment *and* competitiveness, UD launched its Commitment to Delawareans, a two-pronged approach to access that: 1) stipulates four years of high school courses and grades that virtually guarantee

Patrick T. Harker is President of the University of Delaware.

Delawareans admission to UD, and 2) pledges to meet resident students' full demonstrated financial need. The Commitment is working: In-state enrollment is up, and transcripts show students are taking tougher course loads.

But what the Commitment doesn't (and can't) alter is the teaching that goes on in Delaware's preK-12 classrooms — the quality of the instruction, the effectiveness of the educators. This is where the

We've invested ourselves so heavily in high-quality teacher training because it's there that we'll guarantee the college readiness and academic competitiveness of Delaware students.

University's proven teacher preparation and professional development programs will make the difference. We've invested ourselves so heavily in high-quality teacher training because it's *there* that we'll guarantee the college readiness and academic competitiveness of Delaware students.

For a long time, this country's education establishment believed that, all other things being equal, teacher quality matters. But research has proved that all other things don't *have* to be equal; teacher quality matters anyway — *and it matters more than anything else.*

This is why the Delaware Teachers Institute (DTI) in New Castle County is so important to UD. Aligned with all the characteristics of high-quality professional development, the Teachers Institute model is one of the most powerful vehicles I've seen for improving teacher effectiveness. It brings university-level learning back

to elementary and secondary school classrooms and raises the bar in terms of what we expect teachers to teach and students to learn.

One of the biggest deficits in teachers' ongoing education is that they're not continually developed in *what* they teach; pedagogy typically eclipses content. Given that deep subject knowledge is an *essential* attribute of high-quality teachers, this omission is troubling. But it's an omission expertly addressed in the Teachers Institute model. The content is contemporary, rich and relevant, and the techniques developed to deliver it benefit from the true collegial partnership of professors and teachers working together. But this intensive and prolonged study yields something even more than deep content expertise. It yields teacher-leaders who rediscover their passion for their subject, the same passion that led them to the discipline years earlier. DTI Director Ray Theilacker, himself a four-time National Initiative Fellow, puts it this way: "Teachers are married again to what they love."

These are the teachers we need in Delaware's public schools. These are the teachers who will set a new standard for engaging, effective instruction; whose curriculum units will build a foundation for consistent quality; whose nuanced knowledge and renewed enthusiasm will coax fellow teachers into DTI and institutionalize this powerful professional development. These are the teachers who will ultimately redefine what we expect of the state's students, and help us *truly* fulfill our Commitment to Delawareans.

As Delaware commences its first four DTI seminars this fall, the excitement is palpable. This is a grassroots effort led by teachers, championed by school and district administrators, embraced by the state and advanced by UD. We enjoy a full and strong community of support eager to see how the Delaware Teachers Institute will transform teaching and learning in Delaware's public schools.

Taking Care of Our Teachers and Students

By Lillian M. Lowery

This is such an exciting time to be an educator in the State of Delaware. I would like to thank the Provost and all of the university officials for being such a great partner. They have been there from the very beginning, traveling with the New Castle County superintendents and teams to learn more about the Teachers Institute model, and we are really pleased that we partnered with the University of Delaware. Your Provost has been in the classrooms of three of your current seminar leaders and given them awards for outstanding teaching. This is what this program is bringing to us.

Dr. Steven Godowsky is one of the most modest people I know. He didn't just help out, he made it happen. Ray Theilacker's account of the Teachers Institute experience completely energized someone who had been around, seen everything. I had the opportunity to travel to Yale with them and one of our teachers, Karen Yarnall from Newark High School, and marveled at the energy of the teachers. How many times do we actually give you professional development opportunities to talk about your craft? When you went to college and majored in art or music or math or science, you did it because you loved it. This Institute, and these seminar leaders, will give you the chance to relive that feeling. I am so pleased that some of our best and brightest teachers, who are those among us tonight, will have an opportunity to dig into what they really love doing in the content area and work with some of the best minds in higher education at the University of Delaware.

Lillian M. Lowery is Secretary of Education for Delaware. Prior to her appointment in 2009, she served as Superintendent of the Christina School District in Wilmington, Delaware. The text of her remarks on this page is taken from talks she gave on two separate occasions: the celebration of the Delaware Teachers Institute at the October 2010 Conference of the Yale National Initiative, and the Inaugural Open House of the Delaware Teachers Institute on January 20, 2011.

We are going to support that however we can.

When I was Superintendent of the Christina School District, I saw what those teachers had seen. I was absolutely amazed. I was a secondary school teacher for over fourteen years, and I saw, just as today, these teachers engaging in higher-order thinking skills around this work in a collegial atmosphere. I walked away thinking, "I wish every teacher in every single classroom could have this opportunity."

The Teachers Institute stands apart from other professional development because it is both creative and responsive to standards.

How does the Teachers Institute really support the kind of education reform that's called for concerning the new STEM curricula? First of all, it stands apart from other professional development because it is both creative and responsive to standards. The teachers' curriculum units, each one of them daunting pieces of research, conform rigorously to the standards. The Institute and the Initiative are packed with accountability. The reading, the research, the engaged conversation around the unit as it develops is just packed with accountability and aligned to your curriculum. This accountability is the basis for creative work that is supervised but not dictated by the seminar leaders. One of the things that drives me crazy is hearing people say, "We have these inflexible standards and benchmarks, so we can't be creative." You prove that wrong. This Initiative, this Institute, proves that wrong.

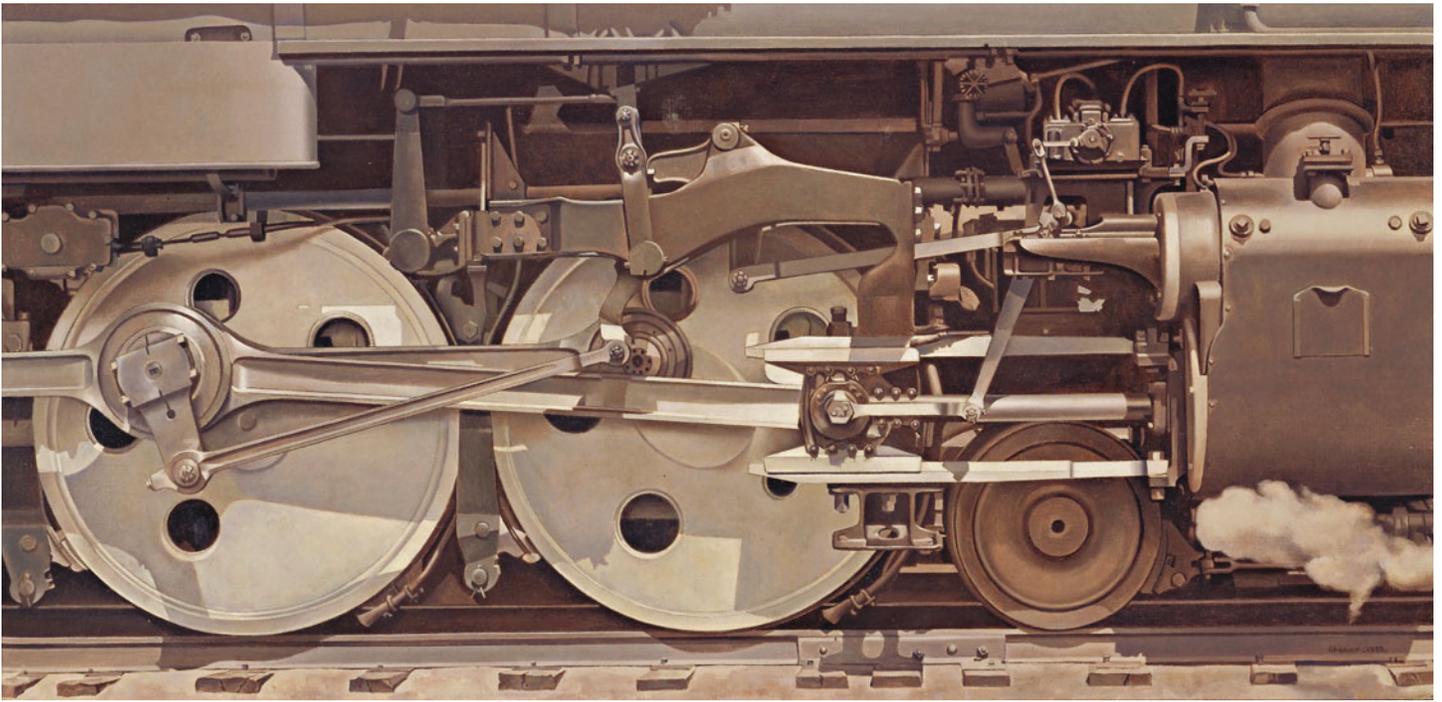
Because we have state curricula that we have to implement, because there are standards and we have to make sure the children meet the benchmarks, we must choose between a little bit of compli-

ance or a whole lot of compliance in professional development. The Institute shows that compliance is easy without being stultifying. One of the things that we administrators have done in adopting the new Common Core Standards — of course, we are one of 38 states to do that — is to develop a Teacher Leader Effectiveness Unit at the Department. We need to know that teachers are ready to prepare students to meet the standards and to inspire their colleagues to do so. We are also making sure that any professional development paid for by Federal or state dollars aligns with benchmarks and standards. The Institute is perfectly designed to this end.

What I heard from the teacher in New Haven was how this approach was intellectually stimulating beyond precedent because it wasn't the kind of uniform, scripted professional development that everyone endures over and over again. It individualizes a teacher's ability to improve content knowledge and brings out higher-order thinking skills. If we want our students to use their higher-order thinking skills, let's model that for them. That's what this Institute allows each of you to do.

Finally, what is most profound for me is that K-12 is in partnership with what happens at higher ed, and higher ed is informing what happens in K-12. We want to make sure our students are college- and career-ready, and this gives children the opportunity to be in a seamless environment with people who are informing education from both directions. I love hearing the teachers talk on these panels. I can't tell the teachers in the room from the Yale and Delaware professors. You're all so very bright and passionate, and I thank you for the opportunity to be here and share this with you.

And thank you, too, Dr. Godowsky, for your vision. Ray for his part is like a dog with a bone. Once he got it, he wasn't going to let it go. Dr. Marchio and the other superintendents, thank you too for taking good care of our teachers so they will take good care of our students.



CHARLES SHEELER, *ROLLING POWER*, 1939

The Driving Force

By Steven H. Godowsky

Returning to the Yale campus to participate in the Annual October Conference was a moving experience for me and for all of the members of The Delaware Teachers Institute team. These educators proudly represented our group as the newest member of the League of Teachers Institutes. This conference was the culmination of our journey to make Teachers Institute seminars a possibility for a larger number of dedicated Delaware teachers who seek genuine, content rich professional development.

I have had an affiliation with the Yale National Initiative since 2005, when our district had the privilege of sending two teachers to the first summer Intensive Session. From that time, and in every year since, we have had interested teachers participate in national seminars. To a person, those "teacher Fellows" returned to start a new school year invigorated and confident in their expanded subject matter knowledge and empowered as leaders. I was

Steven H. Godowsky served from 2003 to 2011 as Superintendent of the New Castle County Vocational-Technical School District in Delaware.

then, and remain now, struck by their level of excitement for teaching and for the high value they place on their Institute experience. Returning to the 2010 Annual Conference to be formally named as the newest member of the League of Teachers Institutes was the realization of a six-year effort to support teachers through the creation of our own Delaware Institute in New Castle County. It is our goal that this unique Institute, consisting of five participating school districts in a partnership with the University of Delaware, will provide teachers with powerful professional learning experiences that truly make a difference in the classroom and meaningfully impact student achievement.

We began designing our plan by modeling the successful Institutes held at Yale-New Haven and in other cities already delivering high quality seminars. However, merging five school districts with a university partner presented unique challenges, consumed much time, and required great patience. We were guided by Jim Vivian, who understood that building a commitment for the Institute model was a process, not a race to win. We addressed building the Delaware Institute

one step at a time, adding district partners, seeking administrative support at the State Department of Education and university levels, and generating interest through regular meetings led by experienced Yale Fellows, especially our City Representative, and now Institute Director, Ray Theilacker. Delaware's winning the Race to the Top Federal grant accelerated that process, providing momentum and potential financial support. The driving force in the development of our plan, however, was the strength of the teachers who embraced the Institute model. They have demonstrated a contagious enthusiasm and collaborative spirit that will make our Institute seminars profound and authentic learning experiences for Delaware teachers.

The Delaware Teachers Institute in New Castle County is truly a teacher led, teacher inspired program that will serve to strengthen our public schools and enhance student learning in meaningful and significant ways. My colleagues and I look forward to providing many engaging and content-rich seminars at the University of Delaware.

The Core of This Transformation

By Tony J. Marchio

Appoquinimink School District has been involved with the Yale National Initiative for four years now, and, as superintendent, I have made three trips to Yale myself to help jump start the Delaware Institute in New Castle County (DTI) for my district and four neighboring districts. It is hard not to get caught up in all of the excitement and enthusiasm of just being associated with a prestigious institution like Yale, but it was not until I was having a lunch break with one of my own teachers that I realized the deeper, more profound impact that the Yale experience has on teachers. "I was ready to give up," the teacher said, "to throw in the towel and just move into another profession. I was just worn out. Now I plan to retire as a teacher."

This "born again" experience is not uncommon among Institute Fellows. Institute fellowship offers teachers something that is badly missing in public education professional development — valuable, in-depth content enrichment. Teacher Fellows become masters in some aspect of their content that sets them apart from all others. There seems to be a lot of personal satisfaction around having that knowledge, and, besides the sense of accomplishment in completing such a rigorous program, it is the feeling of confidence that comes with content mastery that is at the core of this transformation. As hard as we educators try, we can't seem to get professional development right, often stringing together a long series of seemingly unrelated topics that may frustrate more than encourage teachers. That is not the case with Institute participation, as the work that the teachers do comes alive in their classrooms. For a school superintendent, knowing that teachers actually benefit from this form of professional development to improve their teaching made the effort to establish an Institute worth it.

Tony J. Marchio served from 1995 to 2011 as Superintendent of the Appoquinimink School District in Delaware.

And so it was the words of one of my teachers that made all of the effort worthwhile. Helping to create DTI has not been an easy task, and on top of the hundreds of other issues that continue to chip away at a superintendent's time, keeping the momentum going took real effort. I feel very fortunate that in our state the Delaware Institute became a joint effort among five school districts. We seemed to draw energy from each other, and when one superintendent got bogged down, the others picked up the pace. We shared ideas in planning, we shared costs, and we now share the responsibility of managing such a big project. What might easily have become overwhelming for one person became much easier when divided by five. No one is out on a limb and everyone gains in the process. Our Institute partnership was more attractive to the university because multiple school districts were involved. I am not sure we would have received the same commitment had just one district been interested, but we were difficult to

ignore when we presented our proposal as a united team.

If there is one criticism that I hear of the Institute it is that such a limited number of teachers is able to participate. While the numbers will increase as DTI grows, participation will still be somewhat limited. Our Institute will never reach the masses, but it definitely will impact those who participate. While only about a dozen of my teachers are now Yale Fellows, they have made an indelible impact on many others. And with eleven teachers now participating as local Fellows, the impact multiplies itself.

(continued on page 26)

This "born again" experience is not uncommon among Institute Fellows.



JOHN STEUART CURRY, BAPTISM IN KANSAS, 1928

A Prehistoric Perspective

By *Thomas M. Leitch*

As I write in the summer of 2011, the Delaware Teachers Institute is about to launch its inaugural season of four seminars for teachers in five school districts in New Castle County. I have met the Fellows in my own seminar exactly once for a preliminary discussion of their goals, my expectations, and the best ways to keep us all on the same page (or rather on related yet productively different pages). How much can you say about an Institute that has yet to embark on its first season of seminars?

Quite a lot, it turns out. For if its history has yet to be written, the Delaware Institute has a rich prehistory dating back to 2004, when Cary Brandenberger Riches and Ray Theilacker, two teachers from Howard High School of Technology, were first invited to participate in Paul Fry's poetry seminar in New Haven. It is no wonder that they returned from the seminar burning with excitement, for the benefits of a more content-rich approach to professional development were obvious.

But many hurdles stood between us and a Delaware Institute. Every existing Institute was based in a big city. Delaware would have to rely on an alternative model: a suburban, multi-district Institute that would require not only cooperation between local school districts and the University of Delaware, their natural partner, but consensus among several district superintendents. Each curriculum unit, we knew from the beginning, would have to address Delaware state standards for grade- and subject-specific instructional goals. Because the University, whose College of Education and Human Development was the state's premier teacher-training institution, had a long history of outreach to Delaware public schools, we would have to make sure that our programming complemented rather than competing with programs that were already in place.

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New obstacles arose during the long march to our inaugural season. The nationwide economic downturn shrank school budgets, strained grant resources, and made legislators and citizens wary of any new programs. Fortunately, Delaware's success in the first round of Race to the Top applications for Federal grants to public education inspired us with the promise of new funding and made educators around the state sensitive to the need for innovative professional development.

I've learned from the Delaware Teachers Institute to pay close and respectful attention to its middle name.

I first heard about YNI in 2005 when Laura Sturgeon, a former student of mine who had been accepted into Dudley Andrew's National Initiative seminar on adaptation, asked my advice about background reading for the unit she was designing. The following year, Laura suggested that I go to Yale myself to see what was happening. Although other commitments kept me from making the trip until October 2008, I found her passion infectious, and on returning, I agreed to serve on the Advisory Board for the yet unborn Institute, then made a second trip to observe two National Initiative seminars last summer before signing on as a member of the Delaware Institute steering committee, a prospective seminar leader, and finally a representative to the National University Advisory Council.

I recount my own experience because I think it's typical. Virtually all the UD colleagues I've talked to about the Institute have wanted to hear more. The biggest obstacle to their further participation is not lack of interest but lack of time. Almost everyone who has made the trip to New

Haven has been enlightened and excited by their experience of the National Initiative. And virtually all of them have returned eager to develop local seminars of their own.

So it has not been hard for us to find or recruit potential seminar leaders. The larger challenge has been to integrate their interests with the needs of the teachers who will become Fellows in their seminars. In this connection, the prehistory of the Delaware Institute illustrates the paramount importance of cooperative partnerships between seminar leaders and teachers, both before and after they become Fellows.

After my own recruitment by a student-turned-teacher, I learned a great deal from my meetings with other teachers. At a roundtable for teachers who had already served as National Fellows, I asked one of them, T.J. Vari, whether he thought teachers could find a local Institute stretching over an entire academic term as appealing or valuable as two weeks at Yale. His answer — "It certainly doesn't sound as glamorous, but it holds out even more promise of close partnerships with a University mentor that can last for years" — was all I needed to hear.

My own decision to propose a seminar in "Media Literacy" grew out of dozens of conversations I had with local teachers and administrators, and I was delighted and honored when our Teachers Advisory Board chose it as part of our opening slate. Once I had a preliminary list of teachers who had been accepted as Fellows, reading their applications and learning about their backgrounds and goals gave me a priceless opportunity to tweak my outline for the seminar, its weekly topics, and its list of suggested readings in order to make it more responsive to their needs. Now I look forward to a term of learning at least as much from my Fellows as they do from me. If there's one thing I've learned from the prehistory of the Delaware Teachers Institute, it's to pay close and respectful attention to its middle name.

A Community I Believed In

By Barbara A. Prillaman

Community has always had a special meaning for me. After graduating from college, I served in the United States Peace Corps. It was during that time that I learned about the importance of a community, of people working closely together to accomplish goals set by the group, such as building a latrine for a family up the mountain, or laying stones in the road leading to the town. Sometimes it was not a pretty scene — with people in very heated debates about which project to choose next. However, decisions were made collaboratively, and on the agreed upon day, each family in the community always sent one member to the "minga" and the work was completed — together. The Institute approach is a lot like this. When I first attended the Yale National Initiative four years ago, I had no idea that this experience would become my community. As I learned and grew confident about subject matter I had feared, I met teachers from around the country who were excited, positive, intelligent, and interested in making a difference in our educational system and their students' lives. I had found a community I believed in!

With the promise of having a national experience at a local level, our community, New Castle County, pulled together. The opportunity to provide quality, content-based professional development for the many teachers in our area motivated our group to meet with our superintendents, talk with our administrators, approach university faculty, and share our curriculum units with our colleagues. We educated others about the Initiative in the hope of creating a network of people who were familiar with and supportive of the Initiative's philosophy, goals, and purpose. Additionally, we continued to meet on both a professional and personal basis. Monthly, we came together to discuss our progress

and make plans for the future. We also met frequently to enjoy a meal, or to watch a play or a film — getting to know each other better. I believe this was of particular importance, as our community spans a vast geographic area and is comprised of five school districts: Appoquinimink, Christina, Colonial, New Castle County Vo-Tech, and Red Clay Consolidated. We not only shared our common cause of bringing the Institute approach to our area, but we also developed a personal investment in each other as well.

Teachers are at the very heart of the Institute approach. As Teacher Fellows, we are valued as the leaders of the decision making processes and the organizational structure. For us, this was evident from the beginning of our involvement. We were the creators, meeting frequently to monitor our progress. We needed to determine how teachers and their students would best be served. This is a process that

we continue to learn about in the first year of our established Institute. Our Fellows are lively and passionate about their beliefs and our meetings reflect this, as they usually include lengthy debates about one matter or another. For me, these meetings are reminiscent of the town gatherings I had sat in on as a young, idealistic Peace Corps volunteer. It is this idea of a community in which people come together to work towards a common goal that makes the Institute unique in our educational field.

As I sat in on our first Seminar meeting this past May, I had to continuously remind myself that this was real, this was happening in Newark, Delaware on the University of Delaware campus. Our work is just beginning, but I have no doubt that this group, as it continues to grow, will remain committed to its beginning — to the community it has established.



KERRY JAMES MARSHALL, GARDEN PARTY, 2003-2007

Barbara A. Prillaman is an English and Social Studies Teacher at Conrad Schools of Science in Wilmington, Delaware.

First Grade Mathematics: Coherent Foundations and the Common Core

By Roger E. Howe

Three Foundational Capacities

What could be simpler than first grade mathematics? In fact, comparative study of textbooks from various countries shows that first grade has a lot to do, and that it is a time to lay down strong foundations. So it is important to get first grade right. Specifically, first grade should provide students with three related foundational capacities.

1. A well-rounded view of the meanings and uses of addition and subtraction.
2. A connected and coherent foundation for the mechanics of computation.
3. A unified understanding of counting number and (linear) measurement number.

Unfortunately, at the moment, standard practice in the United States fails to accomplish any of these goals. What might we do to remedy such failures? It should be quite possible, and the rationale for doing so is implicit in the Common Core State Standards (CCSS) (2). In some sense, it is a matter of implementing the CCSS correctly, with an emphasis on coherence. A fuller discussion of these ideas is given in (3). Here we summarize basic points.

About 1): Mathematics educators have identified 14 types of one-step addition and subtraction word problems.¹ These 14 types fall into 3 main classes:

- Change, referring to situations when a quantity changes over time;
- Comparison, referring to the comparison of two quantities;
- Part-part-whole, referring to a group made of two subgroups.

The categories of change and comparison each involve two main subtypes. Change can be positive (Change +) or negative (Change -). Comparison can be to the larger quantity (Comparison, more) or to the smaller (Comparison, less). Each of these subcategories comprises 3 types of problem, according to what is unknown.

¹ See Table 2, page 98 of (2).

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ROBERT INDIANA, *THE TEN STAGES NUMBER SCULPTURE REFLECTED*, 1980

Thus, in Change problems, the unknown can be the final amount, the change, or the original amount.

To develop a robust sense of the operations of addition and subtraction, and of when and how they can be used, children should deal with all these problem types, on a repeated basis, with harder numbers as their computational fluency grows. Moreover, explicit attention to the structure of these problems, and comparison of different types of problems, can be expected to increase student language skills as well as their mathematics, and will help students down the road to successful decoding of word problems, which is a major hurdle in mathematics education everywhere.

About 2): Learning the addition/subtraction facts (sums of single-digit numbers, and related subtractions) has long been a staple of first grade mathematics instruction. The good news is, this is one of two essential ingredients in learning fluent and flexible computational methods for adding and subtracting. The bad news is,

we do a poor job connecting it with the other ingredient, which is understanding the principle of place value, and how it governs writing numbers and computing with them. A full understanding of the ramifications of place value takes years to develop (4), but it should start in first grade, using three key ideas:

- i) Every two-digit number is a sum of some 10s and some 1s. Thus, 24 is 2 10s and 4 1s. The left digit tells you how many 10s are in the number, and the right digit tells you how many 1s.
- ii) When operating (adding or subtracting) with two-digit numbers, one first operates independently with the 10s and with the 1s. Then, regrouping is done as needed.
- iii) The nature of the regrouping process is already revealed in learning the higher addition/subtraction facts (the facts involving a sum larger than 10).

There are well-developed teaching sequences that embody these principles (3), and in particular combine learning the

(continued)

Howe: First Grade Mathematics

addition/subtraction facts with the beginnings of learning place value. These teaching sequences are widely used internationally, including countries that are most successful on international comparisons, but they are far from standard in the United States.

About 3): The main idea here is that rods of various lengths can represent numbers, namely multiples of some specified unit length, and that addition and subtraction correspond to simple operations with rods. Addition corresponds to concatenation — laying the rods end-to-end. Subtraction corresponds to comparison: laying the rods side-by-side and measuring the difference (in the sense of finding another rod that matches the difference). This provides a direct connection between arithmetic and geometry that will build over the years.

Linking the principles

It is important also that points 1)-3) be linked to each other. The addition/subtraction word problems can be used as the context for calculations. They can be introduced and discussed when learning basic facts, and they can be prompts for more difficult computations. Rods can be used to represent addition/subtraction facts and to model word problems with small numbers. When two-digit numbers are introduced, the base ten structure can be reinforced by representing the numbers as trains of ten-rods and one-cubes. Addition and subtraction of numbers can be represented by concatenating and comparing these trains, and regrouping can be represented by literally trading one ten-rod for ten cubes, or vice versa. Also, the step of taking apart the two-digit numbers into their tens and their ones, and recombining these, is a palpable physical process when working with trains of tens and ones. The teacher must help students see the connections at appropriate moments.

Connecting to the CCSS

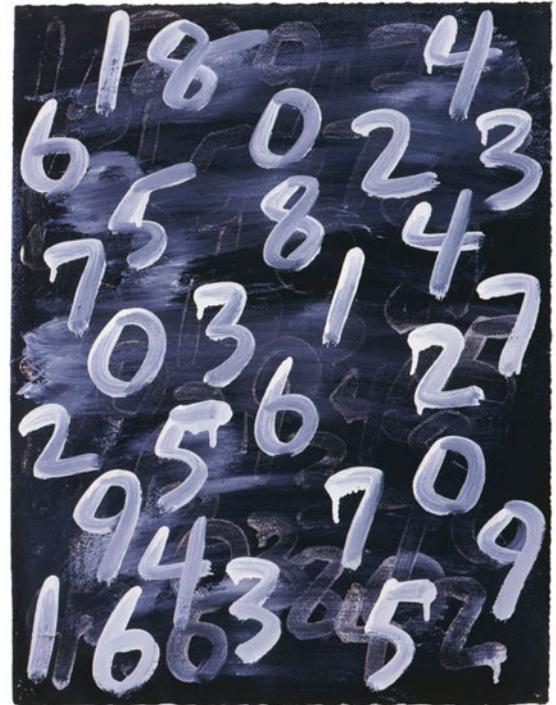
At this moment in the United States, recommendations about mathematics instruction

cannot hope to garner serious attention without taking into account the Common Core State Standards (2), developed in 2009-10 by the Council of Chief State School Officers and the National Governors Association, and since adopted by over 40 states. The three principles sketched above can be mapped very well to the CCSS. Indeed, it seems fair to describe these ideas as a more focused and more cohesive version of the CCSS.

The first CCSS standard on addition and subtraction mentions all the problem types of point 1), and Table I on page 88 gives the full taxonomy. There is less emphasis on understanding all the problems and on comparative discussions in CCSS, but such discussions can be regarded as the concrete realization in the first-grade context of some of the standards for Mathematical Practice, including Practice Standard 1: "Make sense of problems and persevere in solving them"; Practice Standard 4: "Model with mathematics"; and Practice Standard 6: "Attend to precision." Several of the standards in "Operations and Algebraic Thinking" should be part of discussing word problems and representing them symbolically.

Point 2) can be mapped in a detailed way to multiple CCSS standards under the headings "Operations and Algebraic Thinking" and "Number and Operations in Base Ten." Section 2 of (3) discusses how to combine these various CCSS standards into the connected and coherent teaching sequence that is widely used in the most successful countries to teach two-digit addition and subtraction.

The standards on measurement of lengths (standards 1 and 2 under "Measurement and Data") can be thought of as part of what is advocated here about point 3). I would like more emphasis on connecting this work with the numerical work than is explicit in the CCSS. Doing this will help prepare



MEL BOCHNER, *RANDOM NUMBERS* (#1), 2002

for introduction of the number line in second grade, and creates a more cohesive overall package.

The CCSS also has some standards that are not related to the program discussed here. There are standards on time, on representing data, and on studying shapes. There is probably time to do some of these things during first grade. This note, however, claims that the three topics highlighted here form the core of instruction, the part that is essential for future work, and it advocates for weaving them together into a coherent whole.

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What Is a Teachers Institute Curriculum Unit?

By Paul H. Fry

The heart and soul of the work done by teachers as Fellows in the local and national seminars is the curriculum unit. Of course they master the seminar content, attend all seminar meetings, contribute to the collegial atmosphere of the discussions, and help each other in countless ways, but their main efforts go into the writing of the 15-25 single-spaced pages of their curriculum units; and the main efforts of the seminar leaders, too, consist in helping to formulate topics for, discussing along the way, and editing drafts of these units.

What follows here are some reports from Fellows who have taught units written in the summers of 2009 and 2010. As it has fallen to me in recent summers to organize and lead a panel on the writing of these units — a process that puts the Fellows under considerable time pressure during the two July weeks when we're together in New Haven for the national seminars — I thought that I might take this occasion to explain what a curriculum unit is, and how it is typically organized.

I should confess that some years of involvement in the Institute had passed for me before I realized that our term, "curriculum unit," is a term with which all teachers are familiar because it is the name of what they write routinely for the approval of their school curriculum committees and principals when preparing their courses. The curriculum units that we require in our seminars, however, differ considerably from this standard practice, largely because they are far more substantive, requiring more description and analysis of a content area than what teachers are normally expected to write.

In format we expect that these units will include: 1) a sustained "narrative," including a rationale for the particular approach chosen, the objectives the teacher hopes to

achieve, and a good account of the background information and content mastery one needs in order to teach the topic effectively; 2) "strategies," a section in which the teacher discusses in general terms the pedagogical methods best suited for conveying the unit's subject matter; 3) "classroom activities," not to be confused with lesson plans because these are meant to be more descriptive of actual teaching procedures than they, typically three in number and chosen to evoke what

Teachers everywhere may have the chance to improve both their own content preparedness and their teaching strategies as a result of reading these units.

the author anticipates to be key moments of breakthrough in the students' absorption of the subject; 4) a list of bibliographical resources suggested for other teachers reading the unit and interested in adapting it to their purposes, a separate list of resources for the students to be taught; and 5) an appendix describing the relation of the unit's content to school district, regional, and national standards, and any other appendices that have typically to do with diagrams or charts employed in teaching the material.

Fellows often find this a daunting task at first. Many haven't written anything so long since college, if even then, and the requirements for completing the assignment seem to yawn menacingly before them. For this reason we try to shape our panels and workshops with assistance that is as detailed as possible; and for this reason too it is such an important part of the collegial experience that the veterans of unit-writing help the first-timers as generously as they do.

Soon enough the Fellows find writing the curriculum unit uniquely rewarding among the tasks they have performed in professional development settings over the years, and take real pride in their accomplishment — not least because their units are published and they themselves become published authors.

Units in local seminars are gathered into volumes of hard copies introduced by the seminar leader, to be distributed in the teachers' school districts together with the electronic circulation of these volumes; and units in national seminars are distributed in comparable volumes electronically nationwide and indeed globally via the National Initiative Web site.

The audience for these units is the teachers' peers from around the world who have found by keyword topics of interest to them. Yes, their local curriculum committees and principals may read them too, but what the Fellows mainly think about as they write is that teachers everywhere who teach in areas similar to their own may have the chance to improve both their own content preparedness and their teaching strategies as a result of reading these units. Our Fellows thus contribute to the quality of education well beyond their own sphere. Justifiably, they can place themselves in the company of the educators whose published books and articles on K-12 teaching they cite extensively in their own units.

Obviously we have no space to show you how good these units are in themselves, and what important contributions they make to the teaching of content in innovative ways across the curriculum; but what we can do is allow you to hear from some of the teachers who have taught their units, and who can give you a sense of their students' excitement in taking a holiday from humdrum lesson plans and finding themselves eager to learn. As space also permits, in some cases we have introduced their reports with an account of the context in which their unit was written provided by their seminar leaders.

Paul H. Fry is William Lamson Professor of English at Yale University.

Poems about Works of Art

By Paul H. Fry

The authors of the two following articles were in my 2010 summer seminar on "Poems About Works of Art, Featuring African American, Hispanic, and Women Writers." Because not all the units involved ekphrasis (verbal responses to visual artifacts), and because we discovered together that there's very little ekphrastic writing in the modern Hispanic tradition (which however is very rich in visual responses to literature), it seemed best to give this collection of units a title that differs from that of the seminar, so it's called "Connecting the Visual to the Verbal in the Classroom." Some years before, I had led a seminar entitled "Poems on Pictures, Places, and People," and for the 2010 seminar I had decided to devote the whole time to a personal enthusiasm of mine, poems about pictures, or rather not just pictures but works of art in general. We went wherever our discussions carried us, but a guiding thread throughout was the notion that writing about works of art gives poets a chance to reflect, by contrast with the visual, on the nature of their own medium.

We spent a few days on the classics, including Keats on the Grecian Urn, Wordsworth on the Beaumont painting of Peele Caste, Elizabeth Bishop's poem called "Poem," about a little painting by a great-uncle, and well-known poems that can be reconsidered when read as ekphrases, such as the oft-taught sonnet by Emma Lazarus that compares the Statue of Liberty with the Colossus of Rhodes. We spent a whole day with poetic responses to Brueghel, especially Auden's "Musée des Beaux Arts" and Williams's "Hunters in the Snow." For the most part, though, more than in any other seminar I've led, we worked with the materials the Fellows themselves were working on.

Brook Blaylock of Charlotte in her unit takes an intermittently ekphrastic approach

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to the teaching of literature through "archetypes," as mandated by her state and school district. As she teaches the stages of the hero's journey, focused on Perseus but touching on many other figures, she introduces a rich array of ekphrastic materials to illustrate these stages: for example, responses to Raphael's *St. George and the Dragon* to illustrate the slaying of a monster, and responses to paintings of Danäe and the Golden Shower or the Annunciation to illustrate the stage called "miraculous birth." She led discussions for us of a satirical middle school poem on Uccello's "St. George and the Dragon" and on Elizabeth Alexander's response to Henry Tanner's splendid "Annunciation."

Chante Givens of Richmond found a place for ekphrasis in her unit introducing third grade students to the reading and writing of poetry. When she first said she intended to teach her students how to write a sonnet, I was skeptical, but she more than convinced all of us in the seminar that she would be as good as her word. The unit offers a rich archive of ekphrastic poems suitable for children, but its special focus, with much across-the-curriculum potential that she outlines, is Greg Pape's poem about Audubon's "Flamingo." We were spellbound by her explanation of how she teaches this poem.

Lying to Tell the Truth

By Brook Blaylock

"I am mythically inclined/ and I like to take my time/ as I travel through the ages/ and across many pages." These lines both open one of my eighth graders' culminating poetry projects and summarize the context of this unit exploring traditional archetypes within the context of ekphrastic analysis. As my student implied, archetypes are everywhere

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("through the ages/ and across many pages"). Representing the transcendence of the human condition and the mystery of the collective unconscious, they emerge as forces inherent within the plots and characters of every story and every painting. They vividly emerge in ekphrasis, begging the question: What better means to introduce students to the primordial and universal understanding of character motivation they unwittingly already possess than to pair the introduction of archetypes with the study of ekphrasis, the verbal analysis of the visual?

My students' adventures with archetypes and ekphrasis began with viewing the painting *St. George and The Dragon*. This 1506 painting by Raphael depicts a knight, our hero, slaying a dragon and rescuing a damsel in distress. It embodies several classic character archetypes easily recognizable to students as well as a heroic stage with which students would become familiar in subsequent lessons. Originally, I planned to show this painting without any introduction or background and assign the task of writing a poem about the painting. My prompt asked students to identify the "plot" of the painting and write the story the painting told. Students identified the characters, and while some students went into more creative detail, most wrote boring and matter of fact descriptions: "The lady in the pink dress wandered away from that little castle in the background and now the knight needs to rescue her." "A knight is fighting a snake/dragon thing and a princess is screaming." While disappointed with the lack of elaboration and detail in student responses, I felt that the identification of the basic archetypal characters in this scene provided the means for a smooth transition into the next stage of analysis, ekphrastic poetry. Ideally, this introduction to ekphrasis and archetypes would be quite simple. I would tell my students to use the initial responses to this piece as a means of brainstorming and turn their prose analysis into a poem about this work of art. I would write the word "ekphrasis" on the board and explain its origin and initiate them into the

courts of ekphrastic poetic expression. I followed this very procedure, making it past the part about writing the poem before my students refused the ekphrastic call! I was met with blank stares and a number of "What do you mean you want us to write a poem about art?" "Why should I write a poem about this when I already mentioned everything there is in the picture?" "If we are looking at the picture, doesn't that tell us the same story as a poem about the picture?"

This final question saved me, and the lesson, as I finally had the opportunity to not only explain ekphrasis but the role of the viewer's response to the art in question. The ekphrastic poet did not have to tell the same story as the artist, they had to tell the story of their interaction with the piece. Abandoning the rest of my planned lesson, I introduced a poem I had analyzed in my summer seminar, U.A. Fanthorpe's ekphrastic response to Paolo Uccello's *St. George and the Dragon*: "Not My Best Side." This poem gives voice to each of the three characters: dragon, princess,

prince/hero, and challenges their traditional archetypal roles. It also tells a very different story than what the average viewer might see. This poem, not even originally included in my unit, provided the frame of reference necessary for my students to engage with, and become writers of, ekphrasis. After analysis and discussion I allowed my students the option of writing a poem about the painting's plot (the initial lesson plan) or selecting one of the three characters in the painting and writing an ekphrastic poem from their point of view. The quality of written responses I received amazed me. My students reveled in adopting the voice of the dragon or princess and very creatively responded to this piece of art. I reveled in my own sort of ekphrastic triumph. The initial reaction of my students exemplified a *tableau vivant* of sorts; staring at me open-mouthed, their silent, gaping expressions representative of the confused faces of those students who had come before this class and the unmodified lesson plans so many had failed to understand. While only lasting a second before punctuated by com-

plaints, this visual picture drove me to a unique verbal response and, ultimately, to an altered instructional plan.

While this might not have been the image I envisioned while planning my introduction to ekphrasis and archetypes, my students fully engaged with ekphrasis and archetypes throughout the lesson. In fact, when I reached the section of my unit on the supernatural birth of heroes, and integrated Elizabeth Alexander's poem, *Tanner's Annunciation*, the previous discussions about ekphrasis involving the response of the viewer, helped students accept the possibly controversial interpretation of Tanner's piece by Alexander. Overall, the familiarity with the ekphrastic poetry tradition I gained in Paul Fry's seminar allowed for an expansion of my curriculum unit beyond what I even initially envisioned. In my unit introduction, I quoted Pablo Picasso's statement that "art was the lie that told the truth." It was within the context of this quote that I imagined students engaging with artworks, easily identifying and writing about the archetypal truths inherent within their images, comparing and contrasting the archetypes of poetry and the brushstrokes in paintings. In my teaching of this unit, I developed a new quote, "My lesson plans are the lies that reveal the truths of student knowledge." Okay, I admit it; I might have been slightly over-ambitious in my unit construction, and while some of my lesson plans were ultimately modified or reinterpreted based on student readiness, my main objectives were still met and I still had the pleasure of watching students identify symbols and archetypes and explain their relevance and value in both visual and verbal texts, as well as witnessing the creation of a number of really impressive ekphrastic poetry responses to artistic cues. It took my students' time, and it took my willingness to study and integrate the knowledge I gained in my summer seminar, but by the completion of this unit my students were, to borrow from my third block poet, "mythically and ekphrastically inclined."



PAOLO UCCELLO, SAINT GEORGE AND THE DRAGON, 1470

Comprehension through Poetry

By Chante N. Givens

Every new school year is filled with expectations and anticipations. Teachers reflect on what they will do and how they can make the school year better. This past school year I was filled with more excitement and anticipation than I had felt before. Last summer while at the Yale National Initiative, I was delighted to be in a seminar with Paul Fry. I had signed up for his seminar that connected the visual arts with written interpretation of these through ekphrastic poetry. I didn't like poetry to begin with, and I had never heard of ekphrastic poetry, yet poetry was something that I had to teach to my students. Little did I know that I would be filled with excitement and a new love for this thing called "poetry."

As each session grew more intense, and I started learning more, questions began to arise. How could I share my new passion for poetry and the different forms of poetry I had learned about? How could I make my students partake in this affection that I had found over the summer? I felt like I was on the top of the world, joyous over my new sweetheart. "YES WE CAN HAVE WORLD PEACE!" was how I felt, nothing could have been better.

So with this mindset, I returned to school. Only, back at my school, reality didn't seem to be so glorious. Truth hit as I met with my teammates to discuss our plans for the year. As they listed the things that we had to get done during our language arts block, our regular Houghton-Mifflin curriculum, the core knowledge curriculum, and our regular small groups, my "YES WE CAN" mentality scaled down to "I THINK WE CAN."

To start, I took thirty minutes once a week from our regular language arts block and called it "Poetry Time." The ultimate goal was to have students develop better comprehension skills by interacting with poetry and become better writers by writ-

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ing their own poems. We began by completing an activity called mirror images. Students were to read different poems and find one poem that explained who they were. This was a big hit! They enjoyed reading the different poems and relating to words that other authors had written. One student found a poem that discussed how a monster had a bad dream. She used this poem and explained that she had nightmares almost every night. Another student found a poem that talked about a messy room. He remarked, "I guess I am not the only one who is messy." I guess not, I smiled.

Yes, my students were learning, but something was missing. Where was the joy I had seen when working on their poetry books?

We continued working on different parts of my unit weekly. Gradually as the "real-life" of school started weighing upon me, and as benchmarks and standards of learning started getting a little more complicated for students, I was forced to choose: continue taking thirty minutes a week for poetry, or apply it to the old curriculum I had been using before. I chose to just use the old curriculum. The thirty minutes was starting to add up in instructional time and became more of a burden than anything else. So, we went back to our normal textbook, vocabulary, spelling, and reading groups. Yes, my students were learning, but something was missing from them. Where had that spark and excitement gone? Where was the joy I had seen when working on their poetry books? Slowly students started to ask "Are we going to work on our poetry books?" It hurt my heart to respond, "Not today."

As the year continued to progress, our Core Knowledge curriculum, made popu-

lar by E.D. Hirsch, most famous for his *What Every Third Grader Should Know*, moved into our unit on poetry. While teaching the lessons, I saw how many of these lessons coincided with the curriculum unit that I had written, so I began incorporating lessons from my unit. When we read *By Myself* by Eloise Greenfield, students responded to poetry by writing their own poems based on this. One of my students did just that when she wrote:

*When I am by myself,
And I close my eyes,
I'm a twin,
I am a fin,
I'm eight,
I am late.*

Her response was taking the same two lines of the original poem, and beginning her own with these. Ironically, her poem was a reflection of herself. She was an only child, though she wished she was a twin, and she actually was almost always late to school.

In response to another poem titled *Trees* by Joyce Kilmer, we discussed personification. Students had an opportunity to write their own poem, giving human characteristics to Saint Basil's Cathedral. As we were working on this, one of my students said, "Isn't this like the elastic poetry we wrote before?" Ahhhhhhhh! I could hear the angels singing. They had remembered! "Yes," I replied to my little girl. "Ekphrastic poetry," I replied being the expert that I was. I could not believe it.

As we worked on the Core Knowledge poetry unit, it became easier to use my own curriculum unit. It was not the burden it had once started to become. Throughout the rest of the year, I watched the spark and excitement return to my children. Their appreciation and comprehension of poetry had grown. What a difference it made! The most exciting part is that I have the pleasure of teaching them again next school year in fourth grade. I know exactly where we will start: with our "elastic" poetry.

Persuasion in Democratic Politics

Editor's Note: Bryan Garsten's seminar on "Persuasion in Democratic Politics" inspired remarkable results, including what follows. Sam Reed offers his report on the unit he taught in collaboration with a Philadelphia colleague, Elizabeth King. In the course of teaching the political rhetoric of Frederick Douglass and President Obama, Sam reports that he rediscovered on the spot the importance of learning how to argue with others without descending into a fight.

Jeff Weathers then shows how one of his quietest students blossomed when preparing an oration in the mode of Lincoln.

Engaging Students

By Samuel A. Reed, III and Elizabeth King

Our school district provides additional supports and a scripted curriculum framework for its Empowerment Schools that are not meeting Adequate Yearly Progress. With this assistance, co-planning and co-teaching this unit allowed us to make teaching the arts of persuasion that many students struggle with more rigorous. This unit integrated media literacy into a traditional reading and social studies context. Our focus was on students' critical thinking, reading, and writing skills, introducing rhetorical devices for debating and crafting persuasive arguments as an innovative feature developed in Samuel Reed's National Initiative curriculum unit.

Middle school students can be an argumentative, opinionated bunch. Their passion and conviction are promising, but we often cringe at their blunt intolerance in speaking. Our solution was to teach the "art of arguing," harnessing their fervor and releasing some of their litigiousness by providing them with the tools used by exemplary rhetoricians in order to discuss "post-racial American society."

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Our roles as a School Based Instructional Specialist and classroom teacher, respectively, provided some flexibility in planning this unit in accordance with core standards. We knew that a unit encouraging our students to deliberate on issues of race carried its own inherent risks. With this in mind, we eased into the unit by first defining and then demonstrating the ways in which students can use what Aristotle called *ethos*, *pathos* and *logos*, key persuasive tools, in everyday situations. Our examples included trying to convince their parents to buy them the latest cell phone and attempting to persuade their teachers not to assign homework. As a formative assessment, in order to ensure that they could identify these rhetorical tools, we asked them in cooperative groups to analyze Sojourner Truth's speech, "Aint I Women," watch visual re-interpretations of the speech, and complete a graphic organizer showing where *ethos*, *pathos* and *logos* are found in the speech.

A few days into the unit we hit our first speed bump. The lesson began with an educational media clip depicting Frederick Douglass's biography, emphasizing his bi-racial identity and the points where he used his rhetorical ingenuity to further the cause of abolition. During this viewing, an outspoken female student shouted, "I hate white people!" We took note of her classmates' facial expressions, ranging from shock to smugness to disapproval to apathy, but no one said anything. The student's outburst made it clear that we had to start with suitable guidelines for engaging in controversy.

With this "teachable moment" in mind, we modified the format of our original lessons, meant to compare Douglass's and Obama's biographies and rhetorical skills, to begin by teaching students deliberative discourse strategies. In a Socratic seminar, we worked out a protocol for talking about race in the classroom that encouraged respect for everyone's views. It was crucial that students take the initiative at this point, as afterwards they held themselves accountable to their own rules and expecta-

tions — such as not attacking an individual or group and being careful not to stereotype or overgeneralize. "I hate white people" became "I don't think what many white slave owners did during slavery was excusable."

From then on, each seminar focused on one controversial statement. At the beginning of the seminar, students were given one of these statements and asked to write, without sharing out loud, whether they agreed or disagreed with the statement and why. "Obama is more black than white" instantly struck a nerve and several students wore their opinions on their faces as they wrote. The ensuing conversation was brilliant, with many speaking and all engaged. Those students who spoke would have made Aristotle proud.

Because students had become more comfortable discussing race, they were able to debate well about Obama's seminal speech, "A More Perfect Union." Students worked in groups to debate whether "Barack Obama's presidency provides proof that racism does or does not exist in America." They practiced their oral deliberations using a flip camera and were able now to provide self-critiques judging their proficiency in using the rhetorical tools they had learned.

As a culminating assessment, students completed choice board activities, creating multi-modal products that demonstrated their knowledge in a broader context than that of the traditional five-paragraph essay. Their activities included resumés, digital comics, skits, monologues, poems, and songs or raps about Obama's or Douglass's biographies or rhetorical abilities. One group of students created a skit that showed Douglass persuading the youthful Obama to stop experimenting with drugs and focus on his education.

This unprecedented level of excitement and energy caught other people's attention. During a walk through visit, school district officials noted a high level of engagement, focus, and quality of student work that they had not seen before.

A Bright Opening

By Jeffrey K. Weathers

One of my proudest moments as a teacher results from the cumulative experiences of the seminar "Persuasion in Democratic Politics": researching and writing the unit and then experiencing the remarkable job my students did writing effective speeches. I wanted them to discover both their selves and the art of persuasion through journal writing and rhetoric, and to create their own version of either Lincoln's Gettysburg or Second Inaugural Addresses for the victims and survivors of William Golding's *Lord of the Flies*.

Students who chose the Gettysburg Address were to contextualize their speech as if they were still on the island, but only after the cruiser's arrival and an imaginary search for survivors and bodies, in order to memorialize the fallen and inspire the living. For the Second Inaugural, students were to imagine themselves at the opening assembly of a school the following year, attempting to bring unity back to the boys and the whole school. All were to include a one or two sentence bio of whomever they imagined themselves to be as speaker.

Most students attempted the Second Inaugural, for which the additional instructions were to carefully select their pronouns as Lincoln did. The additional instructions for the Gettysburg Address were apparently considered more difficult: include an extended metaphor.

I am proud of all the students, but especially of one student, Brian, who mesmerized everyone who heard his speech that last day of class. He chose the Gettysburg Address.

The students spoke in the order of their lottery numbers and followed the instruction not to applaud each speaker, allowing for minimal distractions, as others were writing finals. As each student finished, they handed in their

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speech and I privately provided praise and suggestions.

Then Brian rose to speak, casually taking his position at the front of the room. He is an unassuming and quiet Chinese tenth-grader who has struggled to survive in school. As he started, his right leg and arm began to swing gently to alleviate nervousness, but his left leg and arm anchored him and his paper. He seemed otherwise composed.

Perhaps as methodically as Lincoln, Brian slowly, with control of each phrase, captivated his audience. One by one, each student looked up and listened, turning to one another and mouthing, "Oh My God." When he finished the room burst into applause, and the remaining students said they feared having to follow him.

Perhaps as methodically as Lincoln, Brian captivated his audience.

I watched the whole spectacle. I knew Brian had worked daily and diligently in class, writing his speech painstakingly, line by burning line. He included traces of Plato's "Allegory of the Cave" and an extended metaphor that captures themes from Ray Bradbury's *Fahrenheit 451*, both of which we had previously studied.

Here is Brian's speech, unaltered and with hints of his second language acquisition, a testament to the power of education:

Biography

I am one of the big'uns on the island. I chose to speak in order to acknowledge what we did on the island and to acknowledge the sacrifice of what Simon and Piggy did for the group of boys.

A Dark Cave

From the day we first assembled, we would work together to ignite a fire on the mountain, but also, a fire in our hearts. Our chief had built up a community, one dedicated to helping us survive and

helping us be rescued. But, we fell into a dark cave of our nightmares, horrified by the beast and caught in the flames of war and destruction.

Now, we are here on this charred, burnt land, once an island, but now the remains of a battlefield. We came in order to honor our fellow boys that fell before us, the ones whose flame tried to bring light and reason to us all.

To some of us, the controversial rescue fire, both on the mountain and also in our hearts, would spark a dangerous and deadly battle among us. We would begin to snuff out, not only our own, but others', internal light, plunging our world into darkness and uncertainty. Our poor ability to discover the truth about the beast and our inability to understand caused us to extinguish the flame of life that burned within these two boys' hearts.

To the rest of us, we fell into a paralyzing fear, needing protection and unable to speak up. We allowed and even took part in our misdeeds in snuffing out those flames of life that tried to guide us. Our fear of the beast shielded our minds and clouding our hearts of the light and the truth.

But, as that we fell into a dark cave of nightmares separated, we will emerge from the other end united. We had not fully lost our light and our fire. It is simply smoldering, like embers glowing with the desire to be set ablaze, awaiting the time in which we will reunite. It will be at that time that we set those embers ablaze. Its flames will burn ever brighter; its light will be our beacon in the darkness.

We must make sure that the lives which were lost on this island were not lost in vain, and that we, as the survivors, must set aside our differences, our fears, and our misdeeds, to become friends, rather than enemies, once again.

Perhaps Brian's words can also serve to honor and inspire the students and teachers, and schools, of America. One day, his children, and the children of all our students, will need to find their own bright opening out of a dark cave.

Creating Lives: An Introduction to Biography

Editor's Note: Inspired by Langdon Hammer's seminar on "Creating Lives," Mika Cade had her students in Emeryville, California, learn about the history of their town by producing collaboratively a biography of their school. They used school yearbooks to study the changes and continuity in the school and its culture and in the surrounding community, and to identify and interview alumni about their experience.

Another Fellow in "Creating Lives," Molly Myers, designed a "Biography Primer" focused on the life of the poet Sylvia Plath.

Voices of Emery Secondary

By Mika M. Cade

"Ok, I'm really going to do this!" I told myself one Sunday evening in October, trying to ignore my increasing jitters. I hadn't felt this way since my first week of teaching several years ago. It was a mix of excitement, nervousness, and the undeniable feeling that I was pushing myself beyond my comfort zone.

It all started in the spring of 2010, when I responded to an e-mail from my principal saying something like "Want to be in a Yale professional development program this summer? The first two people who respond get to go." I went. There was a moment when I felt totally overwhelmed (and a few more like that along the way) but support I received from everyone around me carried me through.

I was in the seminar entitled "Creating Lives" led by Langdon Hammer. I had no idea what to expect, but after the Organizational Session in May I became immersed in my topic. When I returned for the July summer Intensive I was again inspired, excited, and encouraged by the thought-provoking conversations in my

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seminar, the support of my colleagues, and the resources available to me through the Institute. I savored the luxury of time to explore what I wanted to teach and how I would do it.

On that Sunday evening in October I wasn't nervous because I felt unprepared; I was nervous because I wanted my experience in the Institute to make itself felt in the classroom. The next day we began the unit with an assessment of student knowledge about biography, using a KWL chart. It was quickly evident that the students knew very little about life writing in any form. They were a little skeptical at first, expecting a run of the mill unit, but their attitudes soon changed.

We then moved into a study of the genre, using biographies of Langston Hughes as our model. We used life sketches from children's books, their own textbooks, and full-length biographies of Hughes to explore the complexities of the genre. I was using the literacy strategies that our English department had chosen to focus on while providing a new topic and new literature for my students.

The main objectives of this section of the unit were for students to define biography, understand its elements, and understand the role of the biographer in creating a story. My students generally felt comfortable with Hughes as a subject, and that allowed us to engage in well-focused discussions of the choices of emphasis each biographer was making. In the final assessment for this section, every student successfully met the objectives and was able to write a critical analysis of the role of a biographer in an in-class essay.

Our study of the genre was the foundation for the more daring part of the unit, an oral history of our high school. I gave students the opportunity to decide which persons they felt were important to interview, what kinds of stories would be told and how they would be told. Students worked in pairs, first interviewing each other and writing biographies of each other. They had to come up with interview questions, tran-

scribe their interviews, and formulate these conversations into cohesive stories about their partners' lives. Working as a pair, they then chose someone to interview who was part of the school community but not a student. They were able to get a wide range of stories from alumni, janitorial staff, administrators, teachers, and support staff. They then repeated the process of interviewing, transcribing, and storytelling.

At the end of the unit, all the students wrote reflections on what they had learned. Several students mentioned that they had felt very challenged and that it was a lot of writing, but that they had fun. Although my students have had longer writing assignments in the past, they have typically been asked to paraphrase or report on the words of others in books, and rarely required to write so many words directly about the real world. My students had to develop their own authoritative voice even while telling someone else's story. They also had to learn how to organize their information and use the best words to convey their story to a larger audience. They did not have a prescribed model for how to do this, yet every student succeeded in turning in a biography, a feat in its own right.

What I learned through the Yale National Initiative was how to push myself beyond my comfort zone to create a challenging, engaging, and fun unit. In turn, my students gained a deeper, more authentic understanding of core English Standards while having fun and being challenged.

Creating a Life

By Molly Myers

"It made me think differently about my writing."

"I got a lot closer to my grandmother. I had no idea how hard her life was."

(continued)

Molly Myers is a History Teacher at Lindblom Math and Science Academy High School in Chicago, Illinois.

Myers: Creating a Life

"Trying to combine her life story with the historical context of the time was the most challenging part of writing the biography."

"I cared more because I knew it was a responsibility to write someone else's story."

While many of these student reflections match the goals that I had set for the year-long biography project that served as the through line for our team-taught women's studies elective course, I did not anticipate just how much the project would change me as well.

As a history teacher, I knew signing up for an English-centered seminar would challenge me to think in new ways. Our first seminar meeting in May began with a conversation presented in Hermione Lee's *Introduction to Biography* about the uses of biography. Is biography meant to be a portrait, presenting the subject in his or her best light, or an autopsy, digging into the minutiae to portray the strictly factual story of a life? This conversation really stuck with me and provided the lens through which I introduced the year-long biography project.

The seminar also introduced me to the biographical subject that would serve as my model for how to navigate the treacherous task of biographical writing: Sylvia Plath. With the help of the seminar leader Langdon Hammer and his extensive knowledge of Plath (The content knowledge of the seminar leader is a huge advantage of the Teachers Institute model), I was able to create a pre-project unit on biography using Plath's work and the multiple interpretations presented in Plath biographies. Another reason I chose Plath was the variety of primary sources that she offered (diaries, drawings, letters, interview transcripts and, of course, her poetry). Through this mini-unit, students could see how multiple biographers took the same textual evidence from Plath's work and interpreted it in different ways. Beyond the project itself, the aim of this unit was to introduce students to critical reading at a higher level. Another part of the pre-project unit was to

examine the act of self-awareness and reflection necessary to write biography. To see another person's life and know which of our interpretations and conclusions come from our own experiences and



ALICE NEEL, PORTRAIT OF ELLEN JOHNSON, 1976

assumptions, requires reflective diligence.

The project itself was a multi-step process of researching, interviewing, writing, and editing. This process was repeated three times throughout the year to help students build up a body of information both from interviews and contextual research to craft a ten-page final biography due at the end of third quarter. Since all students were charged with selecting a woman over 40 years old as the subject of their biography, the course content served as a foundation of the context that they could compare with the biographical story they were developing. With the help of the Fellows from my biography seminar, I was able to concretize my expectations for the interviews and offer opportunities to practice prior to scheduling the first interview.

This brainstorming session over the summer was critical to making this project work. When thirteen dedicated educators discuss the stages necessary for a successful oral history project, magic happens.

Elementary teachers offered great advice on scaffolding skills and being clear about directions and high school and middle school teachers offered great insights for how to overcome potential resistance by students. Such collegiality is another awesome advantage of the Teachers Institute approach.

Finally, the ten-page biographies served as the jumping off point for students to find a more creative platform for their work. While some students chose to enhance their biographies through further editing, adding images, and a cover, other students elected to use technology for their work. Multiple students used video software to create documentaries, others chose Web site software or glogster to learn how to make a Web site to honor the story of their person, and, finally, two dance students combined the work they did in each class and created a modern dance guided by their voices to reflect the story of their person's life. (Video can be found at <http://bit.ly/jDQMix>.)

Through all of this, I changed. I changed by taking on a seminar subject that challenged my way of thinking about biography. I changed through discussions in seminar about the responsibility of writing a life and the perils and possibilities therein. I changed by surrounding myself with colleagues who know more about teaching and learning than I do. I changed by committing to team teach with a teacher who inspires me and intimidates me. I changed by taking on a subject matter, the story of female archetypes through history and literature, that I knew would at once be controversial and engaging. I changed by reading student work and seeing their development as writers and thinkers. I changed a lot and it all started by filling out the application for the Yale National Initiative.

The Mathematics of Wallpaper

By Roger E. Howe

In the seminar "The Mathematics of Wallpaper," we studied the principles of the mathematical approach to symmetry. These ideas were implicit in Greek geometry, but emerged explicitly around 1830 in the work of Évariste Galois, of tragic destiny, on the theory of equations. In the 1870s, they were adapted by Felix Klein to promulgate a new and far-reaching conception of the nature of geometry. In the 20th century, they became central to theoretical physics, starting with Einstein's special theory of relativity in 1905. However, they also shed light on matters mundane and aesthetic, including the possibilities and constraints of symmetry in wallpaper design.

A key aspect of the mathematical approach to symmetry is to regard symmetry not as a passive property of an object or design, or any kind of structure, but as active, something that you do to the structure. A little more precisely, a *symmetry* of some structure is some sort of transformation of the structure that preserves all the essential properties of the structure.

To take a very simple example, imagine a square. If we reflect it across either of its diagonals, it looks the same. These reflections are symmetries of the square. We can also reflect it in the lines that connect the midpoints to two opposite sides, and we can rotate it by 90° , 180° , 270° around the center. This gives 7 transformations (4 reflections and 3 rotations) that are clearly symmetries of the square. There is an eighth: doing nothing — leaving every part of the square where it is. This is called the *identity transformation*. Understanding that it is important, indeed, vital, to include the identity transformation among the symmetries of any system, was a key insight, very much like understanding the importance of 0 for doing arithmetic.

A far-reaching consequence of thinking

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of symmetries as transformations is that you can combine them, by doing one after another, and the result will again be a symmetry. Rotating the square by 90° and then doing it again produces a rotation by 180° . Less obviously, if you reflect the square across one diagonal, and then across the other, the combined effect will again be rotating by 180° . It can be an engaging challenge to visualize the result of applying various symmetries in succession. The technical term for doing two transformations in succession is *composition*.

The upshot of the possibility to combine transformations is that the list of all symmetries of an object should always contain the composition of two of them. This is called *closure under composition*.

The symmetries of the (Euclidean) plane are the kind of transformations known as *isometries*, or *congruences* — transformations that preserve distances, and move any line segment to a segment of the same length. As Rosemary describes, in elementary school students are usually introduced to three types of isometries: reflections (aka "flips") across lines, rotations (aka "turns") around points, and translations (aka "glides" or "slides"). However, the 4th type of isometry is a kind of Cinderella, in that it is rarely if ever mentioned: the glide reflection. As described in Rosemary's essay, this consists of a translation along a line, followed by (i.e., composed with) a reflection across

the line. Thus, the collection of all flips, turns and slides is not closed under composition: you need to add at least glide reflections to the list.

The wonderful thing is, that's all you need. The collection of flips, turns, slides, and glide reflections fills up the set of all isometries. In particular, if you compose any two of these transformations, you will always get another one, never anything new. In other words, the glide reflections perfect the list of isometries: there are no more waiting to be discovered. That is why I cheered with Rosemary in reading that one of her students recognized a glide reflection at Fallingwater.

The 4th type of isometry is a kind of Cinderella, in that it is rarely if ever mentioned: the glide reflection.



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Math and Design

By Rosemary Schmitt

Can we engage our students in active learning by applying math in an art classroom? This form of active learning is threatened by recent curricular developments. As we add more mathematics to the middle school curriculum, we must eliminate other classes, with the result that classes providing the practical application of math are no longer available to our students. As a middle school teacher, I am always looking for ways to import math from my classroom into other activities, such as art. In my "wonderful world of math" classroom, my students think that math confines itself to that room, never to be seen anywhere else. In this unit on symmetry, I show my students that math lives in the art classroom too.

As with most of my best planned lessons, things change as my teaching continues. I decided to teach this unit on symmetry in conjunction with a field trip that was planned to Fallingwater. My colleagues and I applied for, and were awarded, a grant that incorporated math, communications, and art through a trip to Fallingwater — Frank Lloyd Wright's greatest work. We took 150 eighth graders to visit Fallingwater in the fall. With so much symmetry on display throughout the house, I decided that this was where I needed to start.

We began by looking at pictures of objects and designs that displayed symmetry.

My students were quick to identify reflection symmetry and at times rotational symmetry. At an early age, students do begin to recognize symmetry, which is usually described in terms of transformation. A transformation of an object is the relationship between one position of an object and another position of that same object. This transformation preserves the structure of the object, and the nature of the transformation highlights specific symmetries of the structure. These symmetries may be related to transformations of reflection, rotation, translation, and glide reflection. (The informal

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terms used by students in elementary grades are flips, turns, and slides.) All of these produce congruent figures (preserving both the size and the shape).

My students were totally engaged when I introduced wallpaper. They were amazed at how a simple design can be transformed through a series of rotations, reflections, and translations to repeat a pattern. Students who usually had trouble with computation seemed to excel in finding symmetrical patterns. Those who have very little interest in math discovered an interest when design was included. They were quick to correct

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other students who seemed to think a particular pattern had both vertical and horizontal symmetry when in fact it displayed just one of the two. These wallpaper samples followed the students to the art classroom. This is where I was most proud. My students initiated and continued the symmetry discussion with the art teacher, whose class with my students I attend when my schedule permits. I was excited to hear the math conversation, especially when the patterns were complex.

Alongside the math conversation in the art classroom, my students were able to identify symmetries at Fallingwater. Although these symmetries weren't as complex as those displayed in our wallpaper selection, it was still amazing to see the symmetrical designs the students were able to identify in architecture. The moment that impressed me the most was when one of my students was able to identify a glide reflection on the property. A glide reflection is nothing more than a reflection followed by a translation parallel to the reflected line. Sounds simple enough, but when seeing this pattern most people

would not think of it as a form of symmetry.

I had intended my students to develop their own wallpaper by creating a geometric figure, using "Geometer's Sketchpad." Owing to time limitations, however, my students picked one of the wallpapers provided and drew a portion of its design on canvas. This became the backdrop for their art project.

In art class the students discussed Shepard Fairey, an American contemporary artist, street artist, and graphic designer. His paintings can be seen on buildings everywhere in Pittsburgh's neighborhoods. He is known for his Barack Obama "Hope" poster, used in the 2008 U. S. presidential election. He was the inspiration for our art project. The students were asked to depict an issue they felt passionate about. It was surprising to see what issues concerned them. Each of them settled on a single image that would show how they felt about their particular issue. They drew this image over their wallpaper designs, and the results are now displayed around our school, demonstrating both their passion and their incorporation of math into art.

Marchio: The Core

(continued from page 12)

Institute Fellows raise the bar for all teachers with their enthusiasm and energy. Teachers Institutes are about quality. I'd much rather inspire a few teachers than fail to inspire a great many. I can say with confidence that, as a result of the Yale Initiative and DTI, we now have more master teachers in our schools. The impact of those teachers creates a new standard of excellence and permeates staff even in adjacent buildings.

We can hope that as the Delaware Institute grows, more teachers will become involved and experience the rebirth of their passion for teaching. Finding good teachers is always a challenge, but keeping those teachers engaged and enthusiastic, so that they will stay in our profession until they retire, is even a bigger challenge and worth the effort.

Nanotechnology and Human Health

By *W. Mark Saltzman*

Humans can comprehend the structures of objects with an astounding range of sizes, from galaxies that we view with telescopes to sub-atomic particles. This seminar addressed two related questions: How does the size of an object influence its properties? What is special about objects that are 1-100 nm in size? The first half of the seminar addressed the first question, by exploring some of the different properties of small and large objects and how those properties influence an object's interactions with the rest of the world. To help focus this discussion, all seminar participants read the book *Why Size Matters* by John Tyler Bonner. In the second half of the seminar, participants considered the second question by exploring the new science of nanotechnology. Nanotechnology is distinguished by the small size of the objects that are created and manipulated. Participants used their understanding of the consequences of size to appreciate the uniqueness of nanotechnology, and the technological hurdles that have been overcome to create ultra-small components. The seminar focused on the potential role of nanotechnology in treatment and diagnosis of disease. Why is nanotechnology being suggested as the solution to so many health problems? To focus the discussion, participants concentrated on the special properties of nanotechnology that make it useful for treating and diagnosing cancer.

Conchita Austin prepared a unit titled "The Relative Nature of Size in Biological Sciences: Let's Start Small and Work Our Way Up." Using biological examples, the unit discussed the influence of size on function. It also discusses biotechnology, which depends on biological machines that are nanometer-sized. Nancy Rudolph prepared a unit called "If You Can See It, It's Not Nano: Working with Numbers at the Extremes." This unit uses concepts derived

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from nanotechnology to help introduce essential math topics for high school students, including scientific notation and exponents.

Starting with Small

By *Conchita L. Austin*

By the end of the "intensive" weekend in May I left New Haven with far more questions than answers, but by July, I was ready and eager for the Summer Session — I had gotten to meet with my seminar leader, the Fellows in my seminar, and everyone else who participated in the national seminars. Everyone I met was open and willing to share ideas and strategies. This opportunity not only enriched me personally and professionally, but gave me a wealth of knowledge and experiences that I have been able to share and pass on to my students.

My students were introduced to the first part of my curriculum unit at the beginning of the fall semester. I integrated a discussion of the metric system into our review of the scientific method and introduction to lab safety techniques. This allowed me to lay the groundwork for the rest of the unit and course by talking about the relativity in size between things that are macroscopic, microscopic, and on down to nanoscale. We kept referring back to this lesson when discussing cells, bacteria, and viruses.

The second part of my unit concerned size relativity in the studio technology for creating B-movie monsters! My students concluded this part triumphantly by generating their own macro- or micro- creatures. I presented this part of the unit right after our study of cells and cell organelles. The students enjoyed watching the old movie clips from the 1930s to 1960s — which were a far cry from movies they are more familiar with, like *Avatar*. Because my classes are large, I had them create their own creatures in groups, and required them

Conchita L. Austin is a Biology Teacher at East Mecklenburg High School in Charlotte, North Carolina.

to explain and justify the scale and materials of their constructions, again as groups. Their classmates gave each group peer reviews of their presentations, and asked them questions about their creations. The students were excited, especially once I informed them that they were being videotaped and that two creature presentations from each class would be shown to the other classes. With this incentive they found innovative ways of making their presentations. These occasions helped to foster inquiry and critical thinking beyond expectations.

I presented the third part of my unit after our discussion of genetics. I updated my Biotechnology PowerPoint presentation and note guide to include several slides on the emerging science of nanotechnology, along with some of the ethical and medical issues surrounding this work in the field of genetics. My students were surprised to learn that there are already products on the market that derive from research in nanotechnology. They were equally interested in the environmental issues surrounding this science, such as the problem of nanopollution. This provided a great opportunity to revisit how human activities affect our ecosystem.

During summer school of this year, I had the opportunity to present my unit in a totally different setting. I was asked to teach for two sessions a multi-disciplined class including students taking Biology, Earth/Environmental Science, Chemistry, and Physical Science. I was allowed to teach whatever I felt passionate about as long as it would include aspects from each of the science disciplines. This proved to be a wonderful opportunity to provide my summer school students with an innovative way to view how interconnected all of the sciences are. I received some of the following responses from my students:

"I learned that nanotechnology is already in use and it has the potential to be helpful and harmful to humans."

"I learned that it changes everything
(continued on page 35)

If You Can See It, It's Not Nano.

By Nancy Rudolph

As a math teacher at a vocational high school, I am always trying to find connections between the mathematics and my students' career areas. Having been a chemical engineer, it was exciting for me to participate in a seminar on nanotechnology and to share cutting edge technology with my students. I began the semester with all of my classes — 11th and 12th graders in Precalculus and 10th graders in Integrated Math 3 — with an activity to assess their prior knowledge about nanotechnology. Students moved to one side of the room or the other based on their belief that a given statement was true or false; none of the students had any prior knowledge. They quickly learned what is possible because of nanotechnology: gold nanoparticles covered with antibodies injected into the body to kill cancer cells, fabric that doesn't stain, self-cleaning toilets, etc.

After the introduction, I used the content I learned in the seminar differently for each class. Following a lesson about how some physical properties of elements change at the nanoscale (one billionth of a meter) because of greater surface area to volume ratio, 10th-grade students built composite "solids" from two common objects found at home. They used their solids to illustrate the meaning of surface area by counting the number of squares of a given size (1 square inch, or 1 square centimeter) needed to cover their solids, and comparing it to the area calculated using measured dimensions and formulas. Students then enlarged or shrunk their solids and found the ratios of surface area and volume to their original solids. The pair of solids served as a visual to emphasize that area changes by the square of the scale factor and volume changes by the cube of the scale factor.

For Precalculus students, the mathematics of nanotechnology focused on the rela-

tive size of nanoscale particles in terms of things they already knew. The lesson reinforced properties of exponents (especially negative) and scientific notation. Students were able to relate my lesson about the properties of carbon that allow it to form nanotubes and buckyballs, two common structures in nanotechnology, to the chemistry they had learned, which triggered questions and enthusiasm. Students were assigned a mini-research project to find an application of nanotechnology of interest to them, and prepare a PowerPoint presentation for the class on its use, how it works, and why they chose it, along with a little personal data.

The most exciting result of the project was the connection students made to their chosen career areas — exactly what we hope to achieve at a comprehensive vocational high school.

Working alone or in pairs, their final products went far beyond my expectations, as did the student responses to the presentations. Students were creative and artistic in their slide presentations; they listened intently to each presentation, and applauded each other. The most exciting result of the project was the connection students made to their chosen career areas — exactly what we hope to achieve at a comprehensive vocational high school. Many of my students were in the Academy of Manufacturing and Pre-engineering. They presented applications in solar panels, robots, wind energy, agriculture, and machining. Students in Nursing presented applications for skin care, cancer diagnosis and treatment, drug delivery for neurologi-

cal diseases, orthopedics, cancer, and correcting paralysis. Dental students presented advances based on nanotechnology in the composite materials used for fillings or tooth replacements and in anesthesia to increase activation time, which allows multiple procedures in a single visit. Students in Auto Body and Auto Mechanics discussed "self-healing" paint, hydrogen fuel cells, and lighter, more durable car panels and windows that make cars safer and more efficient. Business Technology students presented ways in which nanotechnology makes computers more powerful with more memory and faster start-up and process times. Culinary Arts students found nanotechnology applications for detecting contamination, improving food storage, and adding vitamins and nutrients without affecting taste. Cosmetology students discussed uses of nanoparticles in skin care, hair care and make-up. Students in Electrical Trades presented a method of generating mechanical power from body movement to replace batteries. Environmental Landscape Technology students discussed applications for water contaminant detection, water treatment and desalination. A Technical Drafting student who plans to study architecture found that carbon nanotubes are being used to reinforce concrete, making it both a stronger and lighter material than steel in building applications. And, finally, an Early Childhood student found an application related to her career area — the five senses — in which a bionic nose uses nanotechnology to detect smells, especially those that can be hazardous, at lower concentration levels than the human nose.

Through the presentations, students learned that nanotechnology touches all facets of their lives. Because the majority of Precalculus students are college-bound, they will possibly learn more about nanotechnology in their career program. At the very least, they have some background knowledge of a growing field and a greater appreciation for its significance.

Nancy Rudolph is a Mathematics Teacher at Paul M. Hodgson Vocational-Technical High School in Newark, Delaware.

Energy, Climate, Environment

By John P. Wargo

Editor's Note: John Wargo's essay describes the seminar he led on "Energy, Climate, Environment." All the Fellows in the Initiative have benefited from John's stimulating lectures on environmental perils. What he says here reflects the urgency of his topic and its importance for teachers.

The science of ecology evolved rapidly during the early part of the twentieth century as naturalists, botanists, and biologists gradually recognized the complex relations among all species on earth. This interdependent web of life is easily upset by human influence through agriculture, forestry, urban development, release of toxic chemicals, and our rapidly changing climate. During the 19th and early 20th centuries human population pressure and economic activity led many to recognize these effects, yet most presumed environmental change to be local in scale.

Ecologists are interdisciplinary scientists who integrate knowledge among the fields of biology, chemistry, geology, and the marine and atmospheric sciences. They normally study relations among species, along with the conditions necessary to maintain biological diversity. Their research focuses on the presence and movement of energy, nutrients, and materials through landscapes or marine environments.

Early in the 20th century ecologists focused on small landscapes such as fields or forest plots, often defined by property boundaries rather than an understanding of physical and biological conditions necessary for life. They attempted to explain the pattern of life in one region, and the underlying forces that have nurtured species, both in the present and the past. For example, scientists did not understand that red spruce decline in New York's Adirondack mountains was caused by pol-

John P. Wargo is Professor of Environmental Risk Analysis and Policy at Yale.

lutants emitted from Midwestern power plants to create acid rains that reduced the trees' tolerance to disease.

The scale of ecological inquiry became global during the height of the Cold War. The U.S. Atomic Energy Commission discovered by 1953 that nuclear weapon explosions in the atmosphere forced radioactive particles into global circulation. These particles would eventually rain or settle to earth and accumulate in terrestrial and marine food webs. Soon afterwards government scientists discovered that every human on earth carried radioactive particles from the atomic tests in their bones, and that the source was a contaminated food supply that especially threat-

Valerie's choice of a region is compelling as it demonstrates a delicate biophysical system under siege. The Chesapeake estuary is the largest in the nation.

ened the health of fetuses, infants, and young children. The enormous scale of this nationally sponsored science made it possible to understand other planetary environmental changes such as climate warming, stratospheric ozone depletion, ocean acidification that threatens coral reefs and fisheries, and collapsing diversity in all of the world's biomes.

It is within this context that Valerie Schwarz chose to teach her students ecology through the concept of a watershed, a region drained by a river, using the nearby Chesapeake Bay to focus student interest. The study of watersheds has a rich history in the field of ecology. These studies examine not just the flow of water, but also the movement of sediments, chemicals and

energy that influence the health and diversity of life in the region. Valerie's choice of a region is compelling, as it demonstrates a delicate biophysical system under siege. The Chesapeake estuary is the largest in the nation, home to nearly 3,600 different species of flora and fauna, containing 8,000 miles of shoreline, and sprawling over 6 states. Its scale and complexity make it challenging to study, and the multitude of political jurisdictions make it even more difficult to protect or restore environmental quality.

The core of the problem is the estuary's vulnerability to chemical contamination; intensive agriculture, especially fertilizers and pesticides, urban development and runoff, and industrial pollution are the primary offenders. Other chemical threats such as mercury are released to the atmosphere far beyond watershed boundaries from power plants, and these accumulate in some species of commercial fish. The importance of the fishing industry is well demonstrated by the abundance of blue crabs: nearly 160 million pounds are harvested from the Bay each year.

Valerie has produced an extraordinary unit that will certainly lead students to understand principles of ecology, their application to the estuary, and the ever-increasing human influence in changing the physical and chemical nature of the watershed. Students will read the history of the Nashua River restoration project in Massachusetts, prepare topographical maps, build watershed models, examine aerial photographs, and conduct field activities such as painting storm drains to teach residents to avoid disposing of hazardous materials in or near them, as they flow directly into the Bay. The unit is exceptionally well-conceived, written with clarity and energy, and it is certain to energize, enlighten, and entertain students. It will certainly improve the quality of their scientific inquiry and will encourage them to become more thoughtful stewards of dwindling and vulnerable natural resources.

A National Treasure

By Valerie J. Schwarz

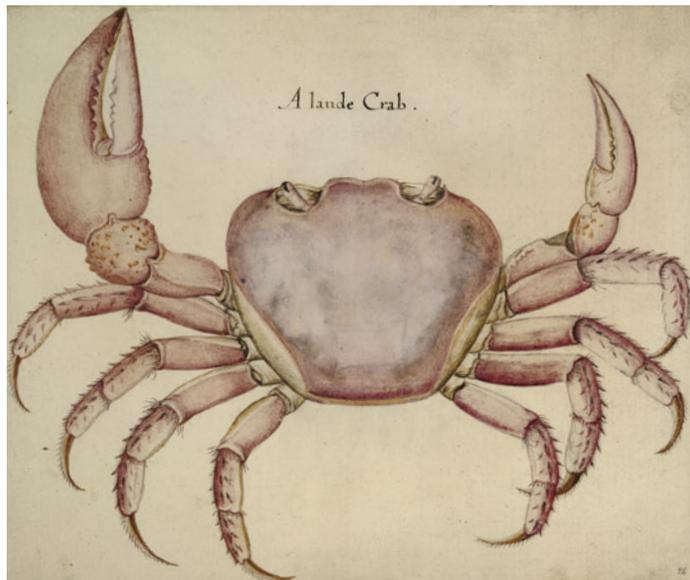
Imagine immersing yourself in the Chesapeake Bay ecosystem by spending three days on an island in the middle of the bay, accessible only by boat. You'd pass hours of each day with your own "private" waterman to teach you about the environment, the history, and the species of the bay. Thanks to the Chesapeake Bay Foundation, eleven other teachers and I did just that, experiencing the mighty Chesapeake at first hand on Smith Island, Maryland.

Putting together my experience with the Chesapeake Bay Foundation, hours upon hours of research, and the expertise and guidance of Yale professor John Wargo, I created an in-depth unit of study, entitled *Teaching Ecology Principles Through the Study of an Ecosystem*, for my fourth-grade students at Mary Munford Elementary School in Richmond, Virginia. As I carefully developed my unit, incorporating all of my newly-gained knowledge, I thought too about how to make it work in the classroom, but what I did not anticipate was the overwhelming enthusiasm of the students. The unit basically took over our class for the entire year.

The theme for the year in our room was crabs. The behavior plan was based on crabs moving toward the crab pot (a crab trap). The students stuffed and sewed paper crabs that hung from the ceiling as decorations. Then the unit began. With the help of a parent volunteer we created a watershed model of the Chesapeake Bay, using bees wax. With this model we could simulate how pollution makes its way through the watershed and into the Chesapeake Bay. We also used aerial photos of the same

Valerie J. Schwarz is a Fourth-Grade Teacher at Mary Munford Elementary School in Richmond, Virginia.

location taken at different times to examine how land use had changed. We observed how oysters filter water, and then we learned how run-off increases the sediment in the bay and smothers the oysters. We also studied the overfishing plight of another natural filter, the menhaden fish. Gradually the students had a very clear picture of the many problems facing the Chesapeake Bay. But the study of the bay



JOHN WHITE, A LANDE CRAB, 1585-1593

did not end when the unit was completed.

Every year the Richmond Ballet works in schools throughout the Richmond area and puts together the annual Minds in Motion performance. Each year there is a theme. Inspired by my unit, I suggested the Chesapeake Bay as a theme. I worked with Catherine Studdard, a Richmond Ballet employee, who choreographed the show. The Chesapeake Bay Foundation became a sponsor for the show. The students worked to learn the dances throughout the year, and in May put on the final performance, "Dancing for a Brand New Bay." There were four performances in all over two days. Roughly, 1,600 students, or 800 per day, watched the performance. Through dance, the show narrated the deterioration of the bay and the threat to its creatures, explaining what needs to be

done to help save the Bay. Members of the Chesapeake Bay Foundation staff were in the audience, and the show brought some of them to tears. At the Saturday shows they were calling additional staff members as far away as Annapolis, Maryland and telling them that they had to come and see the performance on Sunday.

In between performances, I spoke with the Chesapeake Bay Foundation employee who had led my trip to Smith Island. Through my conversation with her, I found out that there might be an opening to take my students on a Chesapeake Bay Foundation field trip to explore the James River, part of the Chesapeake Bay watershed. My class lucked out, and we were able to go on the trip in June. The students spent a gorgeous day aboard the *Baywatcher* on the James River. They learned more about the Chesapeake Bay watershed, saw peregrine falcons and nesting bald eagles, and tested the water to determine whether it was a healthy environment. They caught

thirteen different animal species in the river. The highlight of course was the blue crab.

This past year, all of our fourth-grade classes participated in the James River Boat Trip, and it was without a doubt the favorite field trip of the year, despite many great trips competing for the honor.

Senegalese poet and naturalist Baba Dioum once said, "In the end, we will protect only what we love. We will love only what we understand. We will understand only what we are taught." The seeds of love for the Chesapeake Bay are planted in all of my fourth graders. I plan to continue teaching this unit in an effort to develop a generation of children who care about protecting the Bay and — once they've learned to care about a particular location — their environment in general.

Green Chemistry

By Gary W. Brudvig

Our consumer-driven society generates a tremendous amount of waste that is threatening the carrying capacity of Planet Earth. The enormous challenge facing us can be summarized in one word: sustainability. "Green chemistry" is a growing field that aims to develop and apply new methods that are more environmentally friendly for the manufacture of products and for recycling of products after they have been used. Important goals of green chemistry are to minimize the waste generated during manufacture of a product and to develop products that are biodegradable or are easy to recycle. There are many common household products on which green chemistry can make an impact, including fuels, plastics, electronics, pharmaceuticals, cleaning products and cosmetics. The aim of this seminar was to illustrate how the principles of green chemistry relate to products that we use every day and how they may lead to a more sustainable society.

My own interest in science stems from my hands-on experiences as a child. Therefore, many demonstrations were included in this seminar — at least one demonstration during each seminar meeting. These demonstrations were chosen so that they could engage the Fellows and at the same time illustrate the scientific principles related to green chemistry. The book by Paul Anastas and John Warner entitled *Green Chemistry: Theory and Practice* was used as the primary text for the seminar. The seminar was greatly enriched during the first meeting in May when Paul Anastas joined our group. Paul is widely regarded as the father of green chemistry and he coined the name "green chemistry." During this first seminar meeting, Paul articulated the need for "green chemistry" and outlined the twelve principles of green chemistry. Several of the Fellows in the

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seminar took advantage of Dr. Anastas's offer to sign his book. During the Intensive Session in July, a focus of the seminar was on case studies of green chemistry. These were taken from "Real World Cases in Green Chemistry" published by the American Chemical Society, which was used as a supplemental text for the seminar. All of the case studies are examples of projects that have received the prestigious Presidential Green Chemistry Challenge Award. We discussed the principle of atom economy as it was applied to improving the synthesis of ibuprofen (Motrin, Advil, Medipren) so that less waste and fewer byproducts are generated in its production. The different types of plastics, and their recycling, were discussed both from the point of view of consumers and as to the chemistry for their production and recycling. A demonstration on the synthesis of nylon added to these discussions. We also discussed greener methods for dry cleaning, washing clothes and dishes, and bleaching. Renewable energy is a key aspect of sustainability. With this in mind, the seminar included a discussion of sustainable energy use in the future that included progress in the development of biofuels and processes for solar energy conversion using artificial photosynthesis. The seminar provided me with an excellent opportunity to connect my own research on photosynthesis to the need for renewable energy and the issues associated with the unsustainable use of fossil fuels that we currently use to power the planet. A highlight of the seminar was a demonstration of the production of biodiesel fuel from cooking oil that culminated in the combustion of biodiesel fuel in an oil furnace burner.

At the end of the seminar, the Fellows prepared an outstanding

collection of curriculum units featuring excellent activities that will engage their students' interest and teach them about green chemistry. A particularly innovative unit was prepared by Rajendra Jaini, based on the Presidential Green Chemistry Challenge Award-winning synthesis of ibuprofen. As he explains in the following article, Mr. Jaini created a murder mystery game that requires the students to work out the steps in the chemical synthesis of ibuprofen in order to determine "who dunnit." I would encourage all teachers of elementary through high school students to review the curriculum units prepared during the Green Chemistry seminar. These materials provide a valuable resource for incorporating topics of science and society related to "Green Chemistry" into the classroom.



JOHN STEUART CURRY, KANSAS CORNFIELD, 1933

Catching "The Headache" with Green Chemistry...Now That's Sexy Science!

By Rajendra K. Jaini

Editor's Note: In his article Rajendra Jaini mentions coining the expression "Sexy Science" with his roommate. The roommate was Eric Laurenson of Pittsburgh. Eric and Raju between them have been especially helpful in guiding less experienced Fellows through the curriculum unit writing process, and deserve special mention in that regard.

Prior to entering Gary's seminar on Green Chemistry, I had no idea how the Yale Teachers Institute experience was about to transform my classroom approach to "learning how to learn." While I had heard about the "constructivist theory" of learning (a method whereby a learner attains knowledge through constructing their own experiences), I had not seen it in action at a content level of this magnitude. As I watched my fellow seminar members engaged with spooling the nylon we were synthesizing in class, I was awed. Questions were going back and forth about the properties, the How's, and the Why's; I immediately knew that this was the way I wanted my students to experience learning. Thus began my quest for the "ultimate unit."

Participating in the Institute is a transformative experience where synergy takes learning to the next level. My roommate (who was in the seminar on the brain) and I coined the phrase "Sexy Science," and vowed that we would not leave the Intensive Session without having created units that pushed our students' minds to new heights, while creating a desire for more knowledge of the sciences. We both taught in urban schools where students' experiences were limited, and both considered the delivering of "soft skills" to our students as important as our curriculum. We both needed Sexy Science to help our

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students connect themselves into the world of possibilities. Sexy Science became our mantra; it became the standard for our deliverable product.

With Sexy Science in mind, I would teach the "basics" of Chemistry while intriguing, provoking, and encouraging the higher order thinking and community skills that my students would need in their post high-school endeavors. The "Science" of my unit formed around the topic of the new Ibuprofen Synthesis Model which epitomized the impact that Green Chemistry could have. The "Sexy" of my unit came from a "Who Dunit?" mystery that my students could solve. To make Ibuprofen,

I would teach the "basics" of Chemistry while intriguing, provoking, and encouraging the higher order thinking and community skills that my students would need in their post high-school endeavors.

several successive chemical reactions are used, with certain atoms being "wasted" along the way. Compounds are created, broken apart, reconnected, combined with other molecules; form new molecules, waste others, and recreate new bonds to form Ibuprofen. It sounded like the perfect plot for a murder mystery (okay, so perhaps you needed to be in Gary's seminar to see it). The end result, though, was the following assignment for the students:

A Murder Most Foul: The D.A.'s office needs your help to convict the Head of the Brufen Family, Ibu Profin Brufen, a.k.a., "The Headache." The Headache is an organized, synthesized chemical drug boss who MURDERED many chemicals in his rise to the top. We have the broken families of chemicals (or what's left of their bod-

ies). We have qualitative and quantitative evidence. Your mission is to 1) Decipher the only paper evidence found on "The Headache," 2) Conduct forensic research to prove quantitatively which chemicals were killed, and in which step, 3) Present this information to Judge Teacher to see if there is enough quantitative evidence to get a conviction, and 4) Calculate "The Headache's" murder ratio, known as atom economy, so that we can accurately describe how murderous he was.

I created a crime scene in my class with murdered molecules (blood oozing out from the broken bonds), scientific street names (clues), and crime scene tape. The day that we began the assignment, I felt honored, as I got the opportunity to do what Gary had done months before: facilitate constructivist learning at its best, answer inquiries with leading questions, and talk about how Chemistry was life! The end result for my students was an understanding that Chemistry was real and fun. As one student wrote, "I never thought that I would use Chemistry, or that it was real, but I know Ibuprofen, and now I know how it's made. I also know that Chemistry is everywhere. I get it Mr. J!" They were learning because they wanted to, not because they had to.

We have now repeated this unit two years in a row. End of Course State test scores have increased 29%. However, my biggest satisfaction came from an e-mail of a former student who wrote, "Mr. J... I wanted you to know that I am doing real good in college. I got an A in my first two Chemistry classes and they want me to major in Chemistry, Mr. J. can you believe it? They were shocked that I knew how ibuprofen was synthesized. Oh, and they got me tutoring other students in Chemistry, and they are paying me really well. Catching 'The Headache' was great, Mr. J. Don't ever change that assignment! Make all of your students do it, because you never know who might change what they were going to do like me."

Now that is Sexy Science...

Editorial, Part I

(continued from page 2)

is devoted also to the celebration of the Delaware Institute in a group of articles by its leaders, and we are delighted accordingly to include contributions not only by Director Theilacker and President Harker but also by Delaware Secretary of Education Lillian Lowery, District Superintendents Steve Godowsky and Tony Marchio, University of Delaware professor Tom Leitch, and Teacher Representative Barbara Prillaman. Delaware is the first Teachers Institute to attempt the coordination of multiple school districts, and many of the writers featured here describe how this novel challenge was met, with valuable lessons for those interested in founding future Institutes. After all, isn't the child in the picture really holding up all of these testimonials for all to read? Look what we've done here! Look what you can do!

Like that child, we feel that the value of our Institute model is self-evident, and Rogers Smith's important study of New Haven teachers who had participated in local seminars (*To Strengthen Teaching*, 2009) clearly demonstrated that in that cohort of teachers there was far greater teacher retention — less burn-out, that is — among teachers who had participated than among those who had not.

But beyond that, as everyone who has had anything to do with teacher evaluation and evaluation of student outcomes knows, the criteria become both murky and controversial. There are so many variables that the test scores of students from the classrooms of teachers with Institute experience are almost impossible to track. The article by Ellen Kisker, an expert in this field, explains the short-term and long-term outcomes for teachers, university faculty, and students touched by our Institutes and takes up the complex topic of evaluating professional outreach programs for teachers. The National Initiative hopes to benefit from her wisdom as it looks to the future.

If the sheet the child holds aloft is homework, though, as it might also be, we can

imagine that it is an A for a first-grade arithmetic lesson as Roger Howe outlines it in his article reminding us that basic quantification needs to be taught with a great many more practical dimensions in mind than are typically taken into account at present. Professor Howe, who has led many of our intensive sessions in math, has consulted on a national committee to devise new core standards for the teaching of primary arithmetic. He is especially impressed by the success of Asian classroom methods — both the mathematical theory behind them and their practical success as evidenced by test scores — and he introduces some of those considerations in his article.

Returning to Pippin's picture, I come now to the qualities that I find most interesting and unusual about it. First, there is the mood established by the intense darks of Pippin's palette. Even though the figures and the setting evoke confidence, serenity, and the feeling that the sky can be reached for — a sky not without clouds, but certainly fair weather clouds — this is nevertheless an honest picture. There is no chiaroscuro, no blending of colors. West Chester, despite boasting citizens like civil rights activist Bayard Rustin and Pippin himself, was only three per cent black when Pippin painted his picture, and still is. Perhaps the suggestion of Pippin's severe dark and light palette is cautiously racial, coding white things such as the neoclassical columns, the technology of the street lamps, the hydrant, and the clocks with their Roman numerals, together with the claim to be foundational insisted on by the statue's pedestal and the flagpole on the roof — coding all those white things over against the darkness of growth and patient perseverance, with the hope of black and white working as one miniaturized in the clothing, the hair, and the bright page of literacy brandished by the child.

Yet this is a darkness that broods; it seeks no artistic or emotional "relief" in settling back comfortably as part of a tableau. It is

literally foregrounded, insisted upon as a reflection without illusion, as the true ground of any possible hope for betterment. Horace Pippin was nothing if not a realist. What looks like the hand of the statue is pointing toward the clock, as if to say, it's getting late. The lights in the building, suggesting overtime work, make it seem even later.

But between the "hand" and the clock there is a tree. Not just in this painting but in others of his, we see Pippin's public buildings through trees, their bold black trunks the closest things to us, proposing themselves as *rival pillars*, the natural architecture of humanity. But what *is* this darkness, more precisely? Pippin does a very odd thing with the flag. In reality the courthouse flagpole is on the front lawn behind the statue (you can see it in photographs), but in Pippin's picture it rises from the building's roof, while the heavily painted black halyard descends improbably, not to the ground (we don't know where it ends), but to the exact top of a pine tree. This tree and its companion standing in front of the pillars insist on tying themselves to the ideas of nationhood and civic justice. They are on the scale of the statue, equally dark and pyramidal, equally important, and they insist, just like the flags in the ground, on the value of rootedness. Insofar as Pippin's image of the statue still does evoke its actual identity as "Old Glory," there again you have the idea of a rooted flag, one that must grow like a tree if it is to retain its glory. Pippin's picture then is a meditation on the necessary interfusion of nature and culture, full of subtly coded warnings that power and privilege must not isolate themselves from grass roots, yet cautiously representing hope in the black and white figure of the child. Nature and culture together, working in difficult harmony with each other in a world shaped by technology and power, are here represented *On Common Ground*.

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Shakespeare and Human Character

By Paul H. Fry

The next article is a follow-up on a remarkable piece of original research carried out during my 2009 seminar, "Shakespeare and Human Character." The Fellows in my 2008 seminar, "Race and Gender in Shakespeare," had taken a particular interest in Harold Bloom's *Shakespeare and the Invention of the Human*, especially in the way that Shakespeare according to Bloom makes consciousness in certain characters (Hamlet, Falstaff, Rosalind, Cleopatra, Edmund) register the capacity to change. On hearing for example that Goneril and Regan in *King Lear* have gone to their deaths competing for his favors, the dying Edmund reflects, "Yet Edmund was beloved," and orders — too late — a reprieve from death for Cordelia. Bloom argues that this sort of discovery through introspection is something crucial and new in the history of human self-understanding. The Fellows' interest in this claim prompted the topic of the 2009 seminar. With this emphasis in mind, the 2009 Fellows studied *Hamlet*, *Henry IV Part I*, *Henry V*, *Julius Caesar*, *Antony and Cleopatra*, and *King Lear*. It proved a worthwhile guiding thread, as whatever other kinds of focus their classroom situations required, their presentation of Shakespeare necessarily passed through considerations of character (you can't get around character because Shakespeare does not follow Aristotle's subordination of character to plot), and all their curriculum units very naturally focused on this issue.

Barbara Dowdall expanded the notion of character within Shakespeare — Othello and Aaron the Moor in *Titus Andronicus*, for example — to the noble character exhibited by actors of Shakespeare,

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African American actors, who braved prejudice and ostracism to pursue their calling. One thinks primarily of Paul Robeson in this regard, and of all the white actors who played black characters



UNKNOWN PHOTOGRAPHER, SCENE FROM "OTHELLO" WITH PAUL ROBESON AS OTHELLO, 1943-44

in blackface rather than allow black actors on the set, but Barbara unearthed a deep archive of materials bringing to life the black actors who successfully overcame obstacles to act Shakespeare, and not just Othello and Aaron, as far back as the nineteenth century. She wrote a unit honoring the namesake of her high school, Asa Philip Randolph, an amateur actor of Shakespeare as well as a social activist, by teaching and encouraging research projects on the history of acting Shakespeare by African Americans. Her unit combines this historical work with reflections on race and racial attitudes in *Othello* and *The Merchant of Venice*.

African Americans and Shakespeare

By Barbara M. Dowdall

Could a veteran English teacher, devotee of Shakespeare, and self-described warrior for social justice journey for three decades in the classroom and be oblivious to the wealth of material on a stunning cast of African American actors performing the Bard for nigh on to two centuries? Apparently yes!

Through the coincidence of covering an African American history class one spring and, with the arrival of Will's birthday on April 23, off-handedly Googling "Shakespeare and African Americans" I discovered the wealth of information on Black America's historical link to the greatest of English poet dramatists. Although I had long known about Paul Robeson and his groundbreaking *Othello*, the 19th century African American expatriate actor Ira Aldridge's forty-year dominance in European Shakespeare productions was totally absent from my awareness, as was the lifelong devotion of my school's namesake, civil rights giant A. Philip Randolph, to reading and performing the Bard.

With the goals of stimulating student curiosity, promising surprises, affirming their status as rising Shakespeare scholars and hoping to spark an ongoing dedication to lifelong learning, I began with a simple question: What

is the earliest date you expect to find African Americans performing Shakespeare? Both at Randolph and the nearby Philadelphia High School for Girls' High, students asked and sought answers to other questions before answering mine: When did Shakespeare live? When were the plays, particularly *Othello*, written? Were actors of color present in Elizabethan theater? When and where did people of African descent arrive in the New World? What was their condition?

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What were their opportunities both educational and vocational and/or limitations thereon? When and where did involuntary servitude come to an end? What would be the interest level in the African American for even reading, let alone performing, the works of a writer seemingly so far removed from their life experience? Assuming that there was such an interest, what would be the roadblocks to success? What would be the response from Black and white theatergoers?

Armed with the basic historical information they deemed most relevant and before being provided the specific text that would satisfy the original query, students went on to make their educated guesses. They ranged from a romantic if inaccurate surmise: "The earliest date I expect to find African Americans performing Shakespeare is maybe in the 1650s, because in 1603 Africans came to Jamestown, Virginia. Once they got settled and once they got free, then they started to perform Shakespeare," to the more conservative "1880s because in 1865 the Constitution was changed and it would take more time for acceptance to occur," to the almost correct crediting New York's end to enslavement some time before instead of six years after the earliest recorded performance: "...after slavery ended in the North, because slaves gathered freely and more frequently."

In speculating about audience response, many correctly guessed that "some in the white community would have been angry and ignorant; that the Black community would have been proud." Propelled by the anticipation questions, students sought out answers and expressed their interest and surprise: "that African Americans had their own theater; that white people came to see

African Americans perform; that Black actors played in Shakespeare before slavery ended."



HENRY PERRONET BRIGGS, IRA FREDERICK ALDRIDGE AS OTHELLO, 1830

Students then had available different doorways to the discovery of African American actors and Shakespeare: by checking particular plays, researching individual actors from a list, or venturing to check on the career of a favorite actor or activist. A Morgan Freeman poster project yielded rich biographical detail but oddly omitted his 1970s era appearances in *Julius Caesar* and *Coriolanus*. A senior girl took extensive notes from her laptop tracing of Maya Angelou's conclusion that Shakespeare was a teen expressing distress: "When, in disgrace with fortune and men's eyes, / I all alone bewep my outcast state."

When asked to judge whether Shakespeare viewed characters like Shylock and Othello as stereotypes or fully

human, students analyzed text to make an assessment: "In the lines beginning, 'If you prick us, do we not bleed?' Shylock insists that everyone is equal and Jews are no different. He is a full human being who bleeds red just as any other."

In the two years since the unit was written, additional African American actors have routinely taken their place in Shakespeare productions — plays as varied as *The Winter's Tale*, *King Lear*, *All's Well That Ends Well* and *Measure for Measure*; and recent scholarship has amplified the historic record, including glowing reviews of Ira Aldridge's portrayal of Macbeth and Frederick Douglass's use of The Scottish Play text in his quest for freedom.

Here is a rich literary field of inquiry where teachers and students can learn together as teachers model both the joy of wonder and the techniques of focused research.

Austin: Starting with Small

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with science and the medical field."

"Nanotechnology has a huge impact on our society because it is in our modern technology. We will be lost without it (technology), we depend on it for everything we use, we will soon adapt to nanotech."

For me, the most significant aspect of the whole experience of being a National Fellow as well as participating in the Charlotte Teachers Institute is how we are all treated as professionals and experts in our area of instruction. Given the overall climate of teacher evaluations, accountability, and pay-for-performance proposals, it is refreshing to feel that what we as teachers are doing has tangible value and is appreciated.

The Brain in Health and Disease

By W. Mark Saltzman

During the summer of 2009, Carol Boynton participated in a Yale National Initiative seminar called "The Brain in Health and Disease." The human brain is a remarkable contraption, capable of decoding complex information about the world around us and organizing that information into plans and dreams. This seminar reviewed the overall structure of the brain and its subdivision into regions that are responsible for different tasks, such as vision, hearing, control of movement, and decision-making. The function of the brain was related to the activity of cells within the brain, particularly neurons, which are capable of collecting, integrating, and relaying information. The seminar also described common diseases of the brain, such as Parkinson's disease, Alzheimer's disease, epilepsy, and stroke, and related the causes and consequences of these diseases to properties of cells and

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groups of cells in the brain. Because the biology of the brain has many levels of complexity, it is a suitable substrate for lesson plans at a variety of grade levels, encompassing aspects of mathematics, biology, chemistry, philosophy, and social studies.

Specifically, the seminar covered the following topics:

1. Cellular structure of the brain
2. Organization of the brain
3. Neurotransmission and the synapse
4. The body manager (major senses and body regulation)
5. Nutrition and the brain
6. Parkinson's Disease and other neurodegenerative disorders
7. Positron Emission Tomography (PET) imaging of the brain
8. Emotions and social function
9. Learning, thinking, remembering
10. Epilepsy

The discussions were enhanced by our reading from three books: *The Dana Guide to Brain Health: A Practical Family*

Reference from Medical Experts, Bloom, Beal, and Kupfer (Ed.), Dana Press (2006); *Think Smart*, Richard Restak, Riverhead Books (2009); and *The Brain that Changes Itself*, Norman Doidge, Penguin (2007).

The Fellows prepared curriculum units that covered a breadth of information on the brain and the senses. The material presented in the units assembled by the eleven participating Fellows spanned an impressive range and was designed for use in classrooms from first grade through high school. Of those units, the one described here by Carol Boynton of New Haven, was impressive in several regards. Carol's unit, called "Sensing our Five Senses," is aimed at the youngest students, yet it provides a clear and helpful introduction to one of the most powerful functions of the nervous system: collecting information about the world that we inhabit. Further, Carol makes the information palpable through a set of hands-on activities to introduce young students to the power of observation through the five senses.

Editorial, Part II: The Rest of This Issue

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The first part of this Editorial is written in tribute to my predecessor as Chair of the Editorial Board, Thomas Whitaker. Tom's editorial in Number 13 of the periodical was an elegant response to one of Jasper Johns's "Catenary Series" paintings, finding points of reference in it to all the articles in the issue. Both in admiration, then, and also because it's the kind of thing I enjoy doing myself, up to this point I have followed Tom by viewing our contents in relation to Pippin's "West Chester Courthouse."

But there's still an important portion of our contents that I haven't mentioned. In turning now to a survey of those articles, I turn my attention likewise to some of our other images, no longer with the enjoyable but of course completely artificial purpose of forcing them to become allegories of our enterprise, but still by way of showing

how interestingly they can illustrate the work done by our teachers, and in many cases how they bring out the strong visual or "graphic" component of this teaching — a quality that's well known to enhance student attentiveness.

Hence before taking up our Fellows' reports on teaching their curriculum units and the images that accompany some of those, I thought I'd offer a word or two about yet other images. This is the third Jasper Johns flag we've put on the cover (see our first issue for the Fall of 1993; the "catenary" painting also features a flag). We like his work in this vein because the problems we seek to address are at once national and local. Johns's flags, like his maps of the States, are never blandly flat, as though seamless and fixed in viewpoint; nor do these flags billow, as over a rampart. They are grainy, textured by individual brush-

strokes, *made* to be a unity, not just given as a unity according to some pre-cooked idea. The images for the Delaware articles can be understood in much the same way. Jacob Lawrence painted a great many images of building and builders; they are urban and cooperative yet resist the feeling of an assembly line or chain gang (think by contrast of Fritz Lang's *Metropolis*). Often they're even rather chaotic: perhaps rough-edged and rough-hewn, but still spirited exhibits of constructive work. Charles Sheeler's *Rolling Power*, with Steve Godowsky's article, represents the irresistible momentum Steve evokes when he says the "driving force" behind the Delaware Institute is "the strength of the teachers who embrace the Institute model." Tony Marchio speaks of the wholly secular "'born again' experience" of many Fellows,
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Sensing Our Five Senses

By Carol P. Boynton

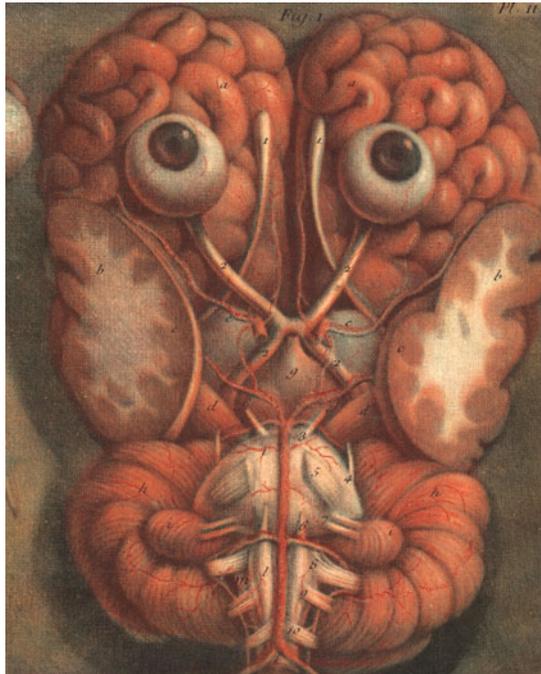
My first-grade students knew something exciting was about to happen as they filed back into the classroom after lunch. There was an unusual object sitting right in the middle of our rug, a place where we gather together to talk, share stories, and learn new things. It was a large, brown, upside-down, cardboard box. Trailing out from underneath this box was a long extension cord waiting to be plugged into a socket. "What is it? What's in there? What are we doing? When do we get to see? Can we look inside?" Questions began flying around the room, exactly the reaction I was seeking. Questioning is the foundation of science and, fortunately for me as a teacher, the foundation of a first grader's day. Weaving together this innate curiosity and science instruction for these students is like slipping a hand into a glove.

Because exploration and discovery are meaningful components of learning about the world around us, young students need to have time to experience open-ended activities. This approach is the guiding rationale for my curriculum unit, "Sensing the Five Senses." Participation in Mark Saltzman's seminar, "The Brain in Health and Disease," was challenging and enriching, an opportunity to learn about how our brains process and store information. There we all sat, primary teachers and high school teachers, working together and ready to write curriculum for our students. But how would I share such complex subject matter as brain function with my first graders? The answer became clear to me as our seminar progressed — my six- and seven-year olds would learn how we become smarter, more informed, as we engage our senses. So, my fundamental focus became heightening my students' awareness that information travels to our

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brain through sensorial experiences, allowing us to gain knowledge that we can use every day.

That autumn afternoon we all sat around the big box as I plugged in the mysterious cord. A flurry of guesses began as we all heard a sound from under the box. "Maybe it's a hair dryer," "I think it's a vacuum cleaner," "Is it a fan or maybe a



JACQUES FABIE GAUTIER D'AGOTY, PLATE II FROM GAUTIER D'AGOTY'S EXPOSITION ANATOMIQUE DES ORGANES DES SENS, 1775

microwave?" Now, with interest and curiosity, it was time to lift the box, exposing a hot-air popcorn popper. With excited oohs and aahs, we watched as the corn kernels bounced around and eventually heard them explode into popcorn puffs. Then, that identifiable smell of popcorn as the aroma filled the room, or at least the students' noses. The excitement for these young ones was building as they asked the inevitable question, "Do we get to eat it?" The popcorn came spilling out into the bowl, a true reward worth waiting for. Finally, the sense of touch and taste were now engaged as the students happily munched away. Our experiment had allowed everyone to

experience all five senses through one fun and delicious lesson.

The learning continued with discovery through exploration as the students worked in science centers that housed an array of sensorial activities. Various unmarked containers held mystery scents, sounds, and objects keeping students learning through guessing, writing, discussing, and confirming information with their science partners. They were excited to hear and identify sounds as they shook unlabeled containers holding beans, rice, sand, pebbles, and nuts and bolts. The smell center seemed to have the most visitors, and repeat visitors, as they sniffed the scents of vanilla, soap, peppermint, garlic, crayons and more. Reaching inside boxes to feel concealed objects seemed similarly exciting and a great, fun challenge to identify what item they would be holding in their hand — what does our sense of touch tell us the object might be?

Throughout the experimental phase, the students developed vocabulary and became more articulate in describing and discussing their scientific findings. Rough, smooth, soft, bumpy, long, sweet, sour, salty, crunchy, heavy, are adjectives that began to creep into their discussions. They continually asked questions and charted their learning — What could it be? What sense is helping me? What am I learning? How can I tell someone else about my learning?

For our final activity, we hiked over to the local nature park for a sensorial scavenger hunt, a great adventure. Students with parent helpers were excited to complete their senses charts, collecting sights, sounds, smells, and "touches" found throughout the park. We did reserve the sense of taste for our bags of trail mix — raisins, goldfish, and chocolate chips!

After three weeks of hands-on experiments and scientific inquiry, I arrived at school Monday morning to the question, "How are we using our senses in science next?" Music to a teacher's ears!

Editorial, Part II: The Rest of This Issue

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and we hope it won't be thought profane to have illustrated his point with John Steuart Curry's uncritically objective *Baptism in Kansas*. Kerry James Marshall's urban back yard illustrates Barbara Prillaman's article on community.

When we chose Mel Bochner's *Random Numbers (#1)* for Roger Howe's article on first-grade math, we didn't have in mind the messiness of these ("random") numbers, although I have to say that at least for me it's the swift spontaneity of Bochner's calligraphy that gives the image its aesthetic appeal. What we took note of, rather, was the numbers beneath the numbers, existing in complex relation to, sometimes intertwined with (like the five over the seven on the right), the numbers in the foreground. This shadowing of single digits, not by each other but by other single digits, illustrates for us the complexity of thought that students must bring to bear on even the simplest problems of addition and subtraction if they are to understand them fully. And with the awareness of complexity comes the probability of useful mistakes, reflected in the numbers that Bochner has erased. A different but equally interesting complexity pervades Robert Indiana's *The Ten Stages Number Sculpture Reflected*, with the same article.

Our section comprising the reports of Fellows who have taught their curriculum units continues a tradition that has been in place ever since the Yale National Initiative was established seven years ago. It is also an oral tradition, featured in a panel that we put together on the first morning of our annual October conference every year, and we consider it one of the most exciting moments of our work together. Seeing these curriculum units brought to life, accompanied by all the surprises that come with putting a plan to work, is exhilarating for everyone. In the written form of this tradition, some of the unit topics are introduced by the Fellows' seminar leaders, and in the case of those that aren't, the curious reader should go to the Introductions on the Initiative Web site written by all seminar

leaders in a given year to the volumes of units written by their Fellows.

Not all these articles are matched with images. Even in the case of my seminar on writing about pictures, we have no image for the report of Chante Givens. In my Introduction to Brook Blaylock's article and hers I mention that Chante had regaled us in the seminar with her strategies for teaching Greg Pape's poem on Audubon's Flamingoes, a poem that calls the students' attention to Audubon's practice of shooting and stuffing all the birds he painted. Chante also showed us an image of the lobby of her school, which has a huge mural of flamingoes, and explained how she got her third graders in an across-the-curriculum exercise to compare and contrast the zoological information that Audubon and the muralist make available. But Chante's report takes us in other directions, so we kept the Audubon on the shelf. The reports arising from Bryan Garsten's seminar on "Persuasion in Democratic Politics" we finally didn't illustrate either. For the article by Sam Reed and his colleague, we thought of an image of tense racial confrontation (which is Sam's theme); and for Jeff Weathers's "A Bright Opening" we thought of a dramatic illuminated clearing in the woods. We had in mind a painting by the California figurative painter David Park for Mika Cade's article on writing biographies of the staff members of her California school. But layout challenges left these hopes unrealized. Another topic that went un-illustrated was "Nanotechnology," the topic of Mark Saltzman's Fellows Conchita Austin and Nancy Rudolph. But then, the point of "nano," as Nancy Rudolph says, is that you can't see it! The last of the Fellows' articles without an image is that of Raju Jaini on "Sexy Science." Maybe if somebody like Wayne Thiebaud had painted — perhaps for this very issue! — a nice bottle of green headache pills we'd have put it in, but as it is we allow Raju's contagious enthusiasm to infect us all.

What makes both teaching and encourag-

ing the writing of poems or prose about works of art worthwhile is that, especially for young people, it allows pictures to tell a story. That's what's so much fun about U. A. Fanthorpe's poem as discussed by Brook Blaylock. It makes Uccello's St. George a silly narcissist, the damsel the long-suffering pawn of a boring macho code, and the dragon a grumpy martyr who wonders, "Why did I have to get stuck in this myth?" The portrait by Alice Neel that we put in Molly Myers's report on the unit she wrote in Langdon Hammer's seminar is not Sylvia Plath and is there chiefly — let's just admit it — because we like it a lot and we imagine that we'd like the sitter. Symmetrical composition by M. C. Escher accompanies Rosemary Schmitt's article on math in the art classroom.

The early American John White's *A Lande Crab* illustrates John Wargo's seminar on "Energy, Climate, Environment," even though land crabs aren't dependent on bodies of water, clean or dirty. Our second image from John Steuart Curry, *Kansas Cornfield*, adorns Gary Brudvig's Introduction to his seminar on "Green Chemistry," and we hope it's green enough to make up for the green headache pills we never found. And finally, for Barbara Dowdall's report on teaching her original research on African Americans acting Shakespeare for my 2009 seminar on "Shakespeare and Human Character," we chose one of the many portraits of Paul Robeson as Othello, together with Henry Perronet Briggs' interesting portrait of Ira Aldridge in the same role more than seventy-five years earlier, confirming Barbara's reminder that the African American involvement with Shakespeare goes back much farther than one might have supposed.

We hope the reader feels the excitement in these reports as much as we do, and as much as we do when we hear such reports at our October conference. These are the "results" that Ellen Kisker's theory of change points toward, and we really do think they speak for themselves.

Enacting a Nationally Significant Approach

(continued from page 1)

I'm proud to join Senators Lieberman and Blumenthal on the Teachers Professional Development Institutes Act, which will facilitate partnerships between school districts and nearby colleges and universities to help improve teaching quality and student achievement in low-income communities. These Institutes create an environment for teachers at all education levels to come together for a free-flowing, uninhibited exchange of ideas on a series of academic subjects that will enrich classroom instruction and help ensure our children receive a proper education.

It was in my home state of Delaware, which is known for being a leader in education reform, that the first Teachers Institute whose partnership involved more than one school district was formed. We all know there's much that still needs to be done to ensure that our children are provided the necessary resources to succeed in our global workforce. Partnerships like these are a strong step in the right direction.

– Senator Christopher Coons

I have co-sponsored and advocated for this legislation because I believe it has the potential to significantly improve the educational opportunity available to our nation's students. The Teachers Professional Development Institutes Act will enable partnerships between institutions of higher education and K-12 systems to ratchet up the content expertise of our educators, and in turn, improve students' readiness for college. We know that when students, especially those from disadvantaged backgrounds, have consistent access to high-quality instruction, their life chances, and those of their families, are dramatically improved.

This proposal tracks the success of the Teachers Institute of Philadelphia, based in my Congressional District, which has brought the resources of the University of Pennsylvania to 25 public schools in West and Southwest Philadelphia since 2007. I commend Congresswoman DeLauro for her leadership on this legislation, which continues her long history of advocacy for our nation's children and for equalizing their educational opportunities.

– Congressman Chaka Fattah

As the son of two educators, I learned at an early age the vital role teachers play in the lives of their students. Teachers Institutes are a good way to provide teachers the training and tools they need to be effective in the classroom. I am pleased that my home state of Delaware is pursuing a Teachers Institute, and I look forward to seeing its continued success.

– Congressman John Carney

In June, Senators Joseph Lieberman (I, CT) and Richard Blumenthal (D, CT) and Representatives Rosa DeLauro (D, CT-3) and Chaka Fattah (D, PA-2) introduced the Teachers Professional Development Institutes Act. Senator Christopher Coons (D, DE) and Congressmen John Carney (D, DE-At Large) and Jesse Jackson Jr. (D, IL-2) have joined them in cosponsoring the legislation.

The purpose of the bill, S. 1240 in the Senate and H.R. 2255 in the House, is to provide Federal assistance to support the establishment and operation of Teachers Institutes for local educational agencies that serve significant low-income student populations in states throughout the nation.

The bill recognizes that 1) "teaching is central to the educational process and the ongoing professional development of teachers in the subjects they teach is essential for improved student learning," and 2) "having a classroom teacher who is

highly effective in every academic subject the teacher teaches will require innovative approaches to improve the effectiveness of teachers in the classroom."

It also cites evidence that

- a) Teachers Institutes enhance precisely those teacher qualities known to improve student achievement,
- b) Teachers Institutes exemplify the crucial characteristics of high-quality teacher professional development, and
- c) Institute participation is strongly correlated with teacher retention in high-need schools.

In a recent report, the President's Council of Advisors on Science and Technology identified the need for Teachers Institutes as exemplary partnerships among schools and STEM professionals.

A variety of programs attempt to bridge the gaps between public schools and the STEM professional community, but not all such programs

provide teachers and schools with resources that are useful in their classrooms. Nonetheless, several programs demonstrate the potential for such connections to benefit K-12 schools. For example, Teachers Institutes, which began in 1978 in New Haven and have since expanded to cities across the country, pair universities and school districts, allowing teachers to identify the topics on which they would like to collaborate. University professors then guide these teachers through inquiry-based learning in a STEM subject area.... It is important that we find ways to harness these sources of partnership and expertise in a committed, sustained way relevant to K-12 teachers and students.

This recommendation reflects the emphasis President Barack Obama and Secretary of Education Arne Duncan have

(continued)

On Common Ground®

Strengthening Teaching through School-University Partnership

Number 14, Fall 2011
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The Yale-New Haven Teachers Institute is an educational partnership between Yale University and the New Haven Public Schools designed to strengthen teaching and learning in local schools and, by example and direct assistance, in schools across the country. In 2004, the Institute announced the Yale National Initiative to strengthen teaching in public schools, a long-term endeavor to influence public policy toward teacher professional development, in part by establishing Teachers Institutes in states throughout the nation.

Enacting

placed on the necessity of high-quality teacher professional development. At the launch of his "Educate to Innovate" STEM campaign, President Obama said, "Passionate educators with deep content expertise can make all the difference." As Secretary Duncan explained:

We don't have enough teachers who really know the content extraordinarily well, particularly in poor and disadvantaged communities. The more we can provide high-quality professional development, so that teachers have deep content knowledge, there are huge benefits.

The Teachers Professional Development Institutes Act attests to the national significance of the Teachers Institute approach to curriculum and professional development. Its enactment would provide a research-based and cost-effective way for school districts to offer high-quality professional development for teachers in the schools that need them most.

The Teachers Institutes, whose establishment the bill would support, would allow many more state and local education agencies to learn about and implement this tested, innovative approach for reforming their teacher professional development policies and practices.

Follow the Teachers Institutes legislation online at teachers.yale.edu/legislation.

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112TH CONGRESS
1ST SESSION

S. 1240

To support the establishment and operation of Teachers Professional Development Institutes.

IN THE SENATE OF THE UNITED STATES

JUNE 21 (legislative day, JUNE 16), 2011

Mr. LIEBERMAN (for himself and Mr. BLUMENTHAL) introduced the following bill; which was read twice and referred to the Committee on Health, Education, Labor, and Pensions

A BILL

To support the establishment and operation of Teachers Professional Development Institutes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 **SECTION 1. TEACHERS PROFESSIONAL DEVELOPMENT IN-**
4 **STITUTES.**

5 (a) IN GENERAL.—Part A of title II of the Elemen-
6 tary and Secondary Education Act of 1965 (20 U.S.C.
7 6601 et seq.) is amended by adding at the end the fol-
8 lowing: