

Curriculum Units by
Fellows of the
Yale National Initiative
Guide
2010

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Preface

In April 2010 the Yale National Initiative to strengthen teaching in public schools® accepted sixty-two public school teachers from thirteen school districts in nine communities in eight states to participate in six national seminars held at Yale. The Initiative is a long-term endeavor to establish exemplary Teachers Institutes in high-need school districts in states throughout the country. Following the approach developed in New Haven and demonstrated in other cities, it builds upon the success of a four-year National Demonstration Project. The League of Teachers Institutes® is an alliance that advances their work locally and nationally.

Teachers Institutes are educational partnerships between universities and school districts designed to strengthen teaching and learning in a community's public schools. Evaluations have shown that the Institute approach enhances teacher quality in the ways known to improve student achievement and encourages participants to remain in teaching in high-need schools.

About two thirds of the teachers, named Yale National Fellows, were from five communities that are planning or exploring the establishment of a new Teachers Institute: Chicago, IL; DeKalb County, GA; New Castle County, DE; Richmond, VA; and the Bay Area in CA. Other National Fellows were from existing Institutes in Charlotte, Philadelphia, Pittsburgh, and New Haven that are members of the League of Teachers Institutes. The Fellows attended an Organizational Session of the seminars held in New Haven on May 7-8. The seminars reconvened during a ten-day Intensive Session from July 5-16.

The seminars, which concluded in mid-August when the Fellows submitted their completed curriculum units, included "Connecting the Visual to the Verbal in the Classroom," led by Paul H. Fry, William Lampson Professor of English; "Persuasion in Democratic Politics," led by Bryan Garsten, Professor of Political Science; "Creating Lives: An Introduction to Biography," led by Langdon L. Hammer, Professor of English and of American Studies; "The Mathematics of Wallpaper," led by Roger E. Howe, William R. Kenan Jr. Professor of Mathematics; "Nanotechnology and Human Health," led by W. Mark Saltzman, Goizueta Foundation Professor of Chemical and Biomedical Engineering; and "Evolutionary Medicine," led by Paul E. Turner, Associate Professor of Ecology and Evolutionary Biology.

The twin purposes of the program were to acquaint public school teachers with the Teachers Institute approach to high-quality professional development, and to cultivate their leadership in either creating or sustaining such an Institute. Each participating teacher wrote a curriculum unit to teach his or her students what they had learned, to

share with teachers in their school district, and to disseminate to other teachers internationally over the Internet. The units contain five elements: objectives, teaching strategies, sample lessons and classroom activities, lists of resources for teachers and students, and an appendix on the district academic standards the unit implements. The curriculum units National Fellows wrote are their own; they are presented in six volumes, one for each seminar.

The Yale-New Haven Teachers Institute is a permanently endowed unit of Yale University, which undertook the National Initiative in 2004. The material presented here does not necessarily reflect the views of its funding agencies.

James R. Vivian

New Haven

August 2010

I. Connecting the Visual to the Verbal in the Classroom

Introduction

The eleven curriculum units in this volume were composed during the Yale National Initiative seminar for 2010, "Poems about Works of Art, Featuring African American, Hispanic, and Women Writers," for which I was the seminar leader. 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. It's also the case that the units fall into interesting groups, according to which I present them rather than alphabetically.

This year's seminar featured three remarkable third-grade teachers who chose very different topics but whose units promise in common to be so surprisingly effective for very young children that I group them together. It was here in particular that working in ekphrastic literature proved quite understandably difficult, even inadvisable, yet one of these teachers actually found a way to do it. Yolanda Bezares-Chavez of Richmond, whose classroom is comprised chiefly of African American and Hispanic children between whom there are sometimes tensions, offers an historical overview of the Afro Mestizo cultures of Mexico (primarily) and Colombia, with a view to increasing mutual understanding between her two groups, and to this end she examines both the poetry and the visual art of this culture. The focus of Chicago's Renee Kreczmer is likewise historical, as she is mandated to teach the history of Chicago, so for this unit she has chosen the Great Fire as seen through the lens of the poetry and visual art that have responded to it – a strategy that can easily be adapted to regional history elsewhere and at almost any grade level. Chante Givens of Richmond, finally, is the teacher who found a place for ekphrasis in her unit introducing students to the reading and writing of poetry. 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."

The next group of four is organized loosely and should be understood as a sequence beginning rather close to the first three units and passing through an emphasis on visual art toward the survey teaching of literature that is featured in the third and last group. Of the four units in this group, the middle two are by middle-school teachers.

Anne Marie Esposito of New Castle County, Delaware, teaches World Literature to high school seniors, for the most part using the perspective (like Bezares and Kreczmer) of cultural history, focusing on the Afghan and African narratives found in *The Kite Runner* and *Things Fall Apart*, respectively; some of the materials used to introduce both these

cultures are ekphrastic, and the descriptions of making and preserving artifacts in the novels themselves are treated in this way. Sean Griffin of New Haven teaches the Harlem Renaissance in an Arts Magnet School, with much appropriate emphasis on the art of Lawrence, Bearden, and others, but attending also to a picture book in the manner of Lawrence that accompanies a poem, as well as to the poetry of Hughes and other. Cara Goldstein of San Francisco is an art teacher who has chosen to focus on certain moments she calls "intermedial," featuring Poetry Comics, Animated Poetry, and tableau vivant (in skit form), all with the intention of expanding students' understanding of what "art" is. The interpretive problems posed by ekphrasis are therefore her constant subject. James Foltz of New Castle County regularly teaches a standard high school course in American Literature. To this syllabus his unit adds an ekphrastic focus: poetry in some cases (Longfellow's "Cross of Snow," for example), but also moments that can be approached as ekphrases in the novels he teaches, for example the letter A in *The Scarlet Letter* and "the eyes of T. J. Ekleburg" in *The Great Gatsby*.

The remaining group of four high-school teachers have in common the obligation to teach literary terms and devices to continuing students at least potentially preparing for AP exams. Like Foltz, Rochelle Baba of San Francisco concentrates much of her attention on *The Great Gatsby*, surrounding her teaching of this text with ekphrastic insights from diverse sources, as well as from poems and pictures on their own – for example a David Hockney painting of a house and swimming pool called *Splash*. Brook Blaylock of Charlotte in her unit takes an intermittently ekphrastic approach 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 the various stages: for example responses to Raphael's *St. George and the Dragon* for an overview, and responses to paintings of Dane and the Golden Shower or the Annunciation to illustrate the stage called "miraculous birth." Karen Lichtenberg Scher of San Francisco teaches the mechanics of poetry by attending especially to sonnets and elegies, while organizing her unit thematically around "love and loss." These emphases then culminate in readings of ekphrastic poems that are themselves in many cases sonnets or elegies or both and respond to paintings about love and loss. The seminar Coordinator Kristen Kurzawski of Pittsburgh, finally, takes up the rich vein of women's ekphrastic poetry, chiefly twentieth century, both to give students a rigorous sense of the variety of ekphrastic procedure (actual, notional, and unassessable ekphrases, with the sub-categories of these) and to introduce a feminist perspective within the largely male syllabus she is mandated to work with. This is a unit in which students can be realistically expected to gain an expert knowledge of the kind of poem studied in our seminar.

What nearly all of these units have in common – apart from their appealing teachability – is the inclusion of a writing exercise. Even some of the teachers who thought it best not to shoehorn ekphrasis into their lessons nevertheless do include a culminating assignment

requiring students to write a poem about a work of art, sometimes in conjunction with a visit to a museum.

Paul H. Fry

Synopses of the Curriculum Units

2010.01.01

[Art and Poetry of the Afro Mestizos](#), by Yolanda Bezares-Chavez

The "Art and Poetry of the Afro Mestizos" is a teaching unit prepared for students of Spanish in the 4th to 6th grades, who should be able to communicate using a basic, but correct, Spanish vocabulary. The unit provides general information about the Afro Mestizos, which is the term applied to those Hispanics who are descendants of the African slaves brought to the Latin American regions during the Colonial Period. The Afro Mestizos have made important contributions throughout the history of the Latin American countries, and they represent the *Tercera Raz*, or Third Root in the identities of Latin America. They have developed a very distinctive art and poetry that reflects their African heritage. I prepared this unit to enhance my students' appreciation of the art and poetry around them by introducing them to a world where past and present merge, producing works of art that are surprisingly intriguing. Teachers will find two classroom activities in which I ask students to explore some of the Afro Mestizo art and poetry. These lessons can be modified to present more challenging activities to students performing at a more advanced level of Spanish. ¡Qu se diviertan!

(Developed for Spanish, grades 4-5; recommended for Spanish, grades 4-9)

2010.01.02

[Historical Perspectives through Analysis of Art and Poetry](#), by Renee Kreczmer

"A poem should capture a moment, not explain it." — *Ralph Fletcher*

My unit's objective is to provide third grade students with the skills needed to understand and create a "captured moment," whether it is a moment captured in words or in images. Although the unit is specific to Chicago history and elementary students, it can be applied to other levels and historic events of any type, simply by changing the materials. This unit of study will be integrated with our third grade social studies curriculum, Chicago History. By the end of this unit, students will be able to describe the ways in which artists tell a story about history through the use of art elements. Students will interpret how a poet creates perceptions, images, and moods through the use of devices. The student will compare and contrast history through art and history through poetry to analyze what information we can learn from both forms. Finally, students will apply their knowledge by creating an ekphrastic poem (poetry written about art) based on art or an artifact using a free verse format.

(Developed for Social Studies and Language Arts, grade 3; recommended for Social Studies, Fine Arts, and Language Arts, grades 3-5)

2010.01.03**From the Thoughts of Another: Comprehension through the Genres of Poetry, by Chante Givens**

When students begin school, their level of excitement is high. They cannot wait until they begin learning. As the years pass from one to another, this excitement quickly dwindles. Students are bombarded with all sorts of information about the rules and regulations of language. By the time they get to me in third grade, they are burned out and are not interested in reading or the enjoyment of it. In this unit, students will be immersed in the joys and understanding of poetry and ultimately write their own poetry anthology. This unit will make poetry accessible for students and allow them to relate to it. Through poetry students will work on comprehension, drawing conclusions, and a variety of other aspects of reading. Students will also learn to write several kinds of poetry ranging from couplets to sonnets. The unit will end with a field trip to the Visual Arts Museum where students will write their own ekphrastic poetry. This fun unit will have students engaged and involved.

(Developed for Language Arts, grade 3; recommended for Language Arts, Elementary grades 2-5)

2010.01.04**Exploring Cultural Conflict through Poetry and Art, by Anne Marie Esposito**

After completing this unit on ekphrastic poetry and art as part of their study of world literature, my students will have a deeper understanding of the literature we traditionally cover in class as well as a broader and richer knowledge of both poetry and art. Through their study of selected ekphrastic poems and the related artwork, my students will engage in a dialogue that compels them to read and reread, not only the poetic response but the "visual representation of a visual representation" too. Reading is key here and it cannot be quick and it cannot be literal. As they read they will see how art can be reinterpreted through verse and how that reinterpretation can add a new layer of meaning to what they see in a piece of art, challenging their original perceptions and possible prejudices. As they explore other cultures through the traditional literary works and the integrated poetry and art, they will gain a richer understanding of these formerly unknown cultures. There is always more than what the eye first sees and it is the required revisiting that yields a richer result.

(Developed for English Honors/World Literature, grade 12; recommended for English Honors/World Literature, grades 12 and possibly 10)

2010.01.05

Reading Art through Poetry, by Sean Griffin

Leading students through this unit will not only help them to explore and experiment with ecphrastic poetry, but also to discover much more about the poetry and artwork of an extremely important era in our country's history—The Harlem Renaissance. Beginning with the exploration of Harlem itself, the unit will build student background through poetry and artwork.

Students will explore ecphrasis through examples of what was happening in Harlem in the early twentieth century in the arts, literature and in music. Focusing on the persona, free verse and the blues, students will find inspiration to write their own poetry by studying the works of poets Langston Hughes and Gwendolyn Brooks. Utilizing technique and style utilized by the poets, students will go on to study great artists such as Jacob Lawrence, William H. Johnson and Romare Bearden. Coupling the art and their own poetry will lead students to create their own ecphrastic poetry from journal seeds through writer workshop and finally to publishable pieces.

Finally students will "publish" their newly created works in a project in which students create their own books of ecphrastic poetry based on their study of the Harlem Renaissance.

(Developed for Language Arts, grade 8; recommended for Language Arts, grade 8, and English, grade 9)

2010.01.06

Finding the Story through Intermediality: PoetryComics, Animated Poetry and Tableau Vivant, by Cara Goldstein

What do Tim Burton, Charles Shultz and Billy Collins have in common? I have listed a film director, cartoonist, and poet. Some of the greatest artists of our time provide us with unique ways in which to see the world, but many teachers would never think that in a unit plan these disparate artists could be combined. How does one use comics to inform poetry or teach Shakespeare? How does poetry have anything in common with film? This unit provides teachers with the tools to be able to use a range of art forms to help students understand content and to process what they understand in a unique and varied way. This subject matter is a powerful tool and has a cross-curricular adaptability if you as a teacher gain an understanding of how combined media can be a wonderful vehicle for delivering content that is initially difficult or intimidating for students. There are many resources that I will talk about that could be of use in an English, Drama, or History class, as well as Visual Art, which is my primary focus.

(Developed for Art 1-2, grades 9-12; recommended for Art, English, and Drama, grades 7-12)

2010.01.07

Writing about the Big Picture: American Ekphrasis, by James Foltz

The titular character from Lewis Carroll's *Alice's Adventures in Wonderland* asks: "What is the use of a book without pictures or conversations?" In this unit, students will not so much ponder Alice's question as they will ponder its "looking glass" image: "What is the use of pictures without literature and conversations?" Teachers and their classes will delve into this question, but also and more specifically, delve into the literary approach to writing about pictures known as ekphrasis. Ranging from the blazing scarlet letter pinned to Hester Prynne to the ghostly eyes of T.J. Eckleburg to Longfellow's burden of a "Cross of Snow" to Ahab's nailing his crew's fate to the *Pequod's* mast, students will explore during a school year through American literature the relationship of text and pictures and of text's power over its optical cousin, which is the written word's ability to manipulate the visual arts' meaning.

(Developed for English II American Literature, grade 11, and AP English Language and Composition, grades 11-12; recommended for English, especially those that use American Literature heavily, High School grades 11-12)

2010.01.08

A Palette of Poetry, by Rochelle Baba

The culture of today is a visual one. Between the advertisements everywhere we turn, Facebook movies, and the use of the Internet, my students are bombarded with imagery, and as a result connect best to my content when they are able to better visualize. Visualization is the most essential aspect of describing anything, and in today's busy world, one way I can help my students to stay more focused, as well as enhance their writing skills, is through ekphrasis—the dramatic description or representation of a visual work of art. Ekphrastic poetry is a genre of literature that requires writers to focus on a piece of art and write about it. When students are trained to look closely at works of art and reason about what they see, they are able to draw inferences about how history, culture and visual arts can influence each other.

I have designed this unit for eleventh grade college-bound students in my American literature class. The perfect complement for this unit will be Scott Fitzgerald's *The Great Gatsby*, a highly symbolic meditation on 1920s America. We will explore the major characters and themes in the novel, along with "learning to look" activities, focusing on a number of art slides that tie in with the themes of the novel. Students will learn to be careful observers, and learn to articulate their thoughts and reactions to writing. Bringing visual art and writing together will inspire my students to create something new—an

ekphrastic poem that reflects both the painting and my students' engagement to think critically.

(Developed for American Literature, grade 11)

2010.01.09

[Lying to Tell the Truth: Archetypes, Art, and Imagery](#), by Brook Blaylock

Archetypes are everywhere. When reduced to their most basic parts, archetypes are nothing more than symbols recurring again and again throughout literature and culture, manifesting themselves on the written page as well as on the canvas of history. They represent the transcendence of the human condition and the mystery of the collective unconscious, forces inherent within the plots and characters of every story, verbal or visual, ever created. According to Nancy Clasby "No story is unique, standing alone, nor does it stand entirely outside of the mind of the reader. An internal dimension is already in place; the psyche is prepared, etched with the patterns of myth. The infinitely varied poetic images of beauty and danger mesh with these imprinted designs to form a lens through which readers see their own situation in a larger perspective." What better means to introduce students to the primordial and universal understanding of character motivation they unwittingly already possess than through the lens of a paired introduction of archetypes—"the etched patterns of myth," and the study of art and ekphrastic poetry? As a result of this union, students can access the "internal dimension" of their "prepared psyches," exploring the symbolic and "poetic images of beauty and danger" as a catalyst for enhanced comprehension. Rather than simply presenting archetypes as a list of repeated symbols for students to memorize and apply in isolated literary examples, a unification of artistic analysis, poetry study, and the writing of ekphrastic poetry affords students a broader and more extensive study of archetypes. This curriculum unit's design applies these principles to create a unit of study both challenging and accessible as students engage with an interdisciplinary exploration of archetypal symbolism, art analysis, and ekphrastic poetry.

(Developed for Language Arts, grade 8; recommended for Language Arts, grade 8, and English, grades 9-10)

2010.01.10

[Examining Poems about Love and Loss](#), by Karen Scher

Leonardo da Vinci, the master of art and science, is said to have been asked the great secret of his creativity and brilliance. His answer? "Saper Vedere," or to know how to see. By studying poetry, with a focus on sonnets, elegies, and ecphrasis, my hope is to arm my students with the tools they will need to know how to "see" literature, poetry and art in a deeper and more meaningful way.

Unlike da Vinci, my 11th grade AP English Literature students often struggle when they attempt to examine, not to mention articulate, what they see. Many students resist this process of examination. Furthermore, when faced with the daunting task of studying poetry, many students are stopped in their tracks. "I hate poetry" is a phrase I hear often.

Accordingly, I will work to counteract these feelings about poetry in my unit, "Examining Poems about Love and Loss," which will take place in my Advanced Placement English Literature course. This unit, devoted to sonnets, elegies, and ecphrasis, will take approximately four weeks, during which time I will meet with students every other day for one hundred minute blocks.

(Developed for AP English Literature, grade 11; recommended for AP English Literature, American Literature, and World Literature, grades 11-12)

2010.01.11

[Demystifying Poetry Using Women's Ekphrasis](#), by Kristen Kurzawski

Poetry is a mysterious medium for students. They respond to it on an emotional level, and that response is usually something like "Yuck!" Even when students enter an honors or an AP English course, where the students are clearly driven or they would not have chosen to sign up for the class in the first place, those same driven students still approach poetry lessons with a sense of foreboding. Ekphrastic poetry, however, provides an entry point for students into a poem. When students read an ekphrastic poem they suddenly feel that basic comprehension of a poem is actually possible—yet simple comprehension is rarely what a teacher is seeking. Ekphrasis is useful because it easily leads into a dialogue about the form and function of a poem and its components. This unit seeks to take students who dislike poetry and know little about it, and transform them into sophisticated and perceptive readers of poetry. By the end of the unit the students will have analyzed 13 poems, taught an ekphrastic poem, completed activities mimicking AP test questions, created their own ekphrastic poem, and written an explanation of how they used form and literary devices to create meaning in their poem.

(Developed for AP English Literature, grade 12; recommended for English, grades 11-12)

II. Persuasion in Democratic Politics

Introduction

Learning how to argue with others without descending into a fight is one of the most fundamental skills of democratic citizenship, but it is one that schools too rarely teach today. Once upon a time, rhetoric was a central part of public education. Today, only politicians and advertisers take time to study the techniques of persuasion. Imagine a world in which ordinary citizens knew something about these techniques – a world in which they could recognize when they were being spun, and knew how to spin back – a world in which more of us could construct compelling arguments, rouse appropriate emotions, and make ourselves trustworthy and credible to different sorts of audiences. Our seminar sought to imagine just such a world by exploring links between rhetoric – the art of persuasion – and particular moments in the history of democratic politics.

We did not let ourselves ignore some of the difficult questions that arise when considering rhetoric: When is the use of rhetorical techniques justified and when is it intrusive or manipulative? How can the inspiring oratory of a leader be distinguished from the inflammatory rhetoric of a demagogue, the propaganda of a tyrant, or the desire-creation of advertisers? We approached these matters by discussing key political figures and speeches from throughout the history of democratic states. We spent time with Cicero, the ancient Roman orator warning his countrymen about a conspiracy against the Republic, and with Lincoln as he crafted a response to the wounds of Civil War. We listened as impressive orators debated the proper conduct of war in ancient Greece. And we noticed how the rhetoric of U.S. presidents has changed significantly over the course of our history, and how that change reflects developing views about what sort of speaking is appropriate for political leaders. We also read more theoretical writings about political rhetoric and its role in democratic politics, from an ancient Greek complaint that good speakers rarely do anything more than pander, to recent advice manuals written by political consultants about how to pander effectively.

As a group we became especially excited by several topics: the question of how the modern *media* – television and the Internet especially – influence both speakers and listeners; the question of how powerful *advertising* is and how students learn to judge their needs for themselves in the face of such strong grasping at their souls; and the question of how the ancient art of rhetoric might help teachers to educate modern students in the all-important skills of *writing and speaking*. I think we were all happily surprised to find how relevant the old craft of rhetoric could still be.

Teachers developed curriculum units that drew these themes in very different directions. Our two second-grade teachers offered units that focused on teaching students how to make themselves trustworthy and credible citizens of their classrooms (Torriann Dooley) and on teaching them to be aware of the way that advertisers try to create in

them new wants and needs (Aisha Collins). Elementary- and middle-school teachers focused on linking great orators in history to basic rhetorical techniques (Adam Kubey, David Probst), with one using Barack Obama's election and his speech on race to raise questions about the vision of America as a "post-racial" society (Samuel Reed) and another linking rhetoric to a strategy for teaching leadership strategies (Anjali Kamat). Our high school teachers could go into more historical depth about various topics: the history of presidential rhetoric (Sonia Henze), a case study in Latin American demagoguery (María Cardalliaguet Gómez-Málaga), and the link between persuasion and international institutions (Deborah Fetzer). Finally, our high school English teacher demonstrated how a unique program of journal-writing could be viewed as an elaborate process of rhetorical invention that helps students find their own voices, proving that rhetoric at its best is not merely the art of adorning our thoughts, but a way of learning how to think (Jeffrey Weathers). Together these units offer proof that rhetoric can easily find its way back into today's classrooms; all it needs is an invitation.

Bryan Garsten

Synopses of the Curriculum Units

2010.02.01

[Hugo Chávez: ¿Persuasión Retórica o Demagógica?](#), by Maria Cardalliaguet Gómez-Málaga

As a result of the unit, students will be able to learn about Aristotle's definition of rhetoric and the difference between logos, ethos and pathos; historical events, politics and other important facts of Venezuela; what sort of language is persuasive; how some leaders use language and persuasion as weapons; and how to recognize, analyze and filter demagoguery. The unit will serve me as a perfect vehicle to practice the Reading for Information section of the Connecticut Academic Performance Test (CAPT), the state-mandated standardized test.

I will use this unit with my Spanish 1 and 2 students, who have a Novice Level on the ACTFL (American Council on the Teaching of Foreign Languages) Performance Guidelines for K-12. Students will hone their higher order thinking skills as they learn to express complex opinions and analyze rhetorical, demagogic and persuasive elements and tactics in various sources.

The unit is recommended for Spanish students with a lower/basic Spanish 1-2 levels, but it could be used on upper level courses with proper modifications.

(Developed for Spanish I, grade 9; recommended for Spanish I, grade 9)

2010.02.02

[Tune into the Tone: What Should We Hear Here?](#), by Aisha Collins

This unit will encourage students in primary grades K-3, to address the issues of credibility in a speaker (Is this someone you feel you can trust?), how the speaker or speech made them feel (Did it make you feel eagerness, happiness etc. towards something), and the author's or speaker's purpose (Is the speaker trying to make you do something or feel a certain way?). Students will understand that universally, speaking is recognized as a portrayal of a person's knowledge, skill and credibility. They will understand that in order to understand the message a speaker is sending they must listen carefully, using techniques to clarify and understand what is heard.

"Tune into The Tone" will be a unit focusing on various aspects of how speeches are important and how they are used to convey messages and prompt actions from others. This unit will give students the opportunity to listen to, analyze, and write speeches on various topics and for varying purposes

(Developed for Social Studies, grade 2; recommended for Reading and Social Studies, grades K-3)

2010.02.03

Responsible Citizens Speak Out, by Torriann Kennedy

Part of being persuasive is making yourself trustworthy. This curriculum unit will begin teaching students to develop good character in order to persuade others to make good decisions. It will bring the ancient study of rhetoric into the 21st century by reminding students their purpose for learning is so they can talk about what they know and argue for something they want.

Students will discover how to develop a model ethos in order to be respected citizens in the classroom community and they will learn how to deliver speeches both written by others and by themselves.

Students will examine speeches and identify characteristics and organizations of them as outlined in this unit. They will use a graphic organizer and employ the writing process, described in the unit, to write their own speeches. Students will practice and memorize their speeches and eventually deliver it to an audience of their peers.

The strategies in this curriculum unit will be integrated into the subjects of reading, writing and social studies and will be taught over the first semester of the school year, starting with the very beginning of the year by encouraging students to develop into model citizens.

(Developed for Reading, Writing, and Social Studies, grade 2; recommended for Reading Writing, and Social Studies, grades 2-5)

2010.02.04

The Role of Persuasion in Global Politics: The United Nations and Millennium Development Goals, by Deborah Fetzer

Today's world grows more and more complex, and this complexity is the result of changes that have occurred over time, over centuries, and now over millennia. This world history unit of study addresses the theme of continuity and change specific to global politics. My teaching experience has taught me that when students are challenged by current events, concepts, and ideologies coupled with hands-on simulations, they are more motivated to become actively engaged in learning. This unit focuses on developing countries, the establishment and mission of the United Nations (UN), and the UN's current role and responsibility to developing nations around the globe as elaborated in the Millennium Development Goals of 2000. More specifically, students will learn the art of persuasion, compose and deliver speeches persuading an audience of their choosing to

provide necessary assistance in a developing country. I am hopeful that this study may help my students to understand current global issues as well as their role as world citizens. As a final note, this unit could be adapted for students in grades 6-12 or for an English class.

(Developed for World History, grade 10; recommended for World History, grade 10, U.S. History, grades 6-7 and 9; and English, Middle and High School grades)

2010.02.05

[Speak up! Presidential Rhetoric in the Modern Era](#), by Sonia Henze

The unit *Speak Up! Presidential Rhetoric in the Modern Era* is a compilation of my experience from the Yale National Initiative seminar, Persuasion in Democratic Politics led by Bryan Garsten. The seminar encouraged me to further investigate the art of rhetoric from Cicero, Aristotle and the American Founding Fathers. Throughout the seminar, and my own research, I became aware of the need to increase persuasion with my students. Adolescents often engage in arguments. Perhaps hormonal changes push young adults to be more argumentative or their discourse is just more noticed in any case, teachers should adapt. The Pennsylvania State and Pittsburgh school district standards encourage mastering persuasive arguments through oral presentations. This unit will guide students through an examination of presidential rhetoric while highlighting skills they can use for their own communication. The culminating project will challenge students to show their mastery of rhetoric in their own persuasive speech. A.P. U.S. History classes, American History courses or American Government classes may benefit from this Secondary curriculum.

(Developed for AP U.S. History, grade 11, and American Government and Civics, grade 9; recommended for AP American History, grades 8 and 11, and American Government, 9-12)

2010.02.06

[Creating Authentic Student Leadership through Rhetoric](#), by Anjali Kamat

I want my students to be problem solvers and use the leadership class as a platform for using their voices to create real change. This unit will guide my students through a process of engaging the school community, assessing the needs of our school, analyzing case studies of community activism and rhetoric, studying possible solutions, and ultimately using rhetorical devices to develop their writing and speaking skills to help launch campaigns to implement those solutions. This unit falls under the umbrella of service learning, which can be defined as pedagogy that integrates academics, civic participation, community service, and reflection. While the skill that students are developing in this unit is rhetoric, the underlying goal is for students to use that skill to become leaders and engage the larger community. Teaching rhetoric in a leadership class

will provide a unique context for students to learn these skills in a very authentic situation.

(Developed for Leadership, grades 7-8; recommended for Leadership, grades 6-9)

2010.02.07

[Educating Tomorrow's Orators](#), by Adam Kubey

How do you persuade someone for positive results? The power of persuasion can be used for many goals, positive and negative, action and inaction, to inspire or to give someone to blame. The goal of this unit is to have students analyze the many parts of rhetoric, spoken and written and use the knowledge gained from understanding persuasive argument for positive goals.

Students will complete multiple mini lessons that are in this unit to complete this goal. First students will analyze their own autobiography to understand ethos. Then students will look at Barack Obama's 2004 Democratic National Convention Speech. This will be followed by looking at the art of rhetoric through historical documents by Aristotle, Cicero. Also students will analyze Robert Kennedy's speech after the assassination of Reverend Martin Luther King Jr. to understand how speech can be used for peaceful purposes. Through these examples, students will use speech to make positive outcomes to potentially violent situations. Through word analysis, students will look at how key words contribute to speech, and last through analysis of decorum, or agreeability of the speaker with their audience by looking at non-verbal characteristics of speakers.

Students will gain an understanding of the art of rhetoric and become able orators for positive change.

(Developed for World History, grade 8; recommended for Social Studies and World History, grades 7-12)

2010.02.08

[To Persuade or Not to Persuade: The Makings of a Persuasive Speech](#), by David Probst

This unit is all about the use of rhetoric to persuade someone. In the unit we will learn the history of rhetoric and those who were influential in shaping it. We will look at the different components of rhetoric and learn about what makes up a good persuasive speech by looking at working definitions but also examples by people who have used rhetoric to make significant impacts and contributions both positive and negative to society. After that we will learn what it takes to put together a good persuasive speech. We will look at the steps that one should follow when putting together a persuasive

speech. It will culminate in the writing of a speech. The goal of the unit is not only to strengthen writing skills but also to enhance verbal skills by learning the art of rhetoric.

(Developed for Language Arts and Social Studies, grade 5; recommended for Language Arts, grades 4-5, and Ancient History, grade 5)

2010.02.09

[Barack Obama's Rhetoric: The Trajectory of a Post-Racial America?](#), by Samuel Reed

The essential question for this unit is: "How persuasive is Barack Obama's effort to inaugurate a post-Black Identity for Americans?" This unit is intended for students in grades 6-8, but could be adapted for high school students. While the unit will be anchored in the persuasive genre, it will integrate media literacy practices through reading, writing and viewing social studies content. This unit will cover such topics as rhetorical analysis, free speech, and civil rights. This unit will guide students' inquiry into how Obama and other orators, such as Sojourner Truth, Frederick Douglass, and Martin Luther King Jr. persuade and influence societies. Students will explore what rhetorical tools are used to address issues of race. Through the study of persuasive speeches students will be able to inquire into what Obama's presidency means in a post-racial America. This unit will culminate with students responding and deliberating about race through multiple digital formats. Students will use Obama's speech "A More Perfect Union" as an anchor text in their inquiry and remix new media products that persuade audiences that Obama is qualified or not qualified to lead a post-racial society.

(Developed for Social Studies and Literacy, grades 6-7; recommended for Social Studies and Literacy, Middle School grades)

2010.02.10

[Paths into Excellence: Journal-Writing as Bedrock for Rhetoric](#), by Jeffrey Weathers

Imagine a school filled with students who truly are self-aware to the degree that brain development at their age allows. Then imagine these students empowered with the realization that they can change their circumstances by changing their mindset. Add to that a clear understanding of rhetoric and a regimented written and spoken practice of it, and we end up with students who are prepared to engage with the world. Fostering their realizations that Education is truly their own and that it actually can open doors for them will, one, reduce the need for argument and, two, strengthen their ability to argue. They will know their selves and how to persuade others, and also when and why there is a need to. This, I believe, provides paths for walking with persuasion into excellence.

(Developed for English III-IV and Literature, grade 10; recommended for English Literature and History, grades 9-12)

III. Creating Lives: An Introduction to Biography

Introduction

That title – "Creating Lives" – indicates the double focus of our seminar. We were concerned on the one hand with creative people who consciously shaped (and in that sense created) their lives, and on the other hand with the way that biography shapes and gives meaning to the lives of its subjects. Our central question was: How does a life become a meaningful story, rather than a series of events? This is an ethical question about how people lead their lives, and a literary question about how narrative gives structure and value, pattern and purpose, to existence.

We kept both sides of the question in view as we learned about the modern history of biography in English, reflected on the methods and aims of this genre (one of the most popular kinds of writing), and dwelt on the moral and political issues it raises. We started with Samuel Johnson's essays on biography and his first experiment in the form, *The Life of Richard Savage*, went forward to Elizabeth Gaskell's *Life of Charlotte Bronte*, and then carried the topic to the twentieth century by considering controversial biographical subjects such as Virginia Woolf, Langston Hughes, and Sylvia Plath. For an overview of the form, we used Hermione Lee's exceptionally cogent and concise guide, *Biography: A Very Short Introduction*.

Our focus was on literary biography. But the ideal of a creative life is not an exclusively or even primarily literary one. It comes down to us from early biographies of heroes and the legends of saints, and it includes potentially people in every walk of life – politics, science, religion, education, military service, the arts. So the scope of seminar discussion, and of the curriculum units created in response to it, was very wide indeed.

In bookstores and classrooms, on television and the Web, autobiography is more prominent than biography (in the US; in the UK, less so). Biography, "the account of a person's life told by someone else" (as Hermione Lee defines it), is a related but different genre of "life writing," and it has distinctive strengths. An important assumption of our seminar was that we all can learn from lives distant and perhaps very different from our own. Biography challenges us to get outside of ourselves and the framework of our experience.

Yet biography persistently forces us to think about the relationship between the biographer and her or his subject (the examples of Johnson and Gaskell foreground this dimension of the genre), and the relationship that we have to them both as readers of biography. In this respect, learning about other people's lives through biography always involves learning about our own. Biography is both about others and our selves (and about the relationship between them).

Biography is provocatively contradictory in at least one other important sense. The form belongs to non-fiction. It is built out of facts, but the framing of those facts is a subjective process influenced by the biographer's bias or personal investment (of which he or she may not be aware), various social or historical contingencies, and specifically literary questions of tone, narrative form, and argument. Biography is poised between literature and history, belonging to neither discipline exclusively.

For our seminar's final meeting, the Fellows became biographers and presented to the class short profiles of someone they knew personally or had learned about, using a variety of materials and methods. The moving discussion that we had of their diverse contributions made it clear that biography can stir powerful feeling in the biographer and raise complex ethical questions about how we relate – and relate to – the stories of other people's lives.

The curriculum units that follow suggest how flexible, suggestive, and just plain useful biography can be in the classroom, at all levels of public schooling and in a representatively wide range of school settings.

Biography might seem like too complex or advanced a literary form for use in first grade. But, as Holly Banning notes, first-grade curriculum often requires students to learn about exemplary figures from American history, and there are many biographies available for early readers. Drawing on memories of her own enthusiasm for biography as a young child, Banning outlines a plan for introducing beginning readers to biography, while also meeting the state mandate to teach them about specific figures in American history such as George Washington and George Washington Carver. She will bring her historical subjects close to her students by focusing on episodes from their childhood to which her students can relate, while foregrounding the same challenge (and opportunity) her students face – learning to read – by emphasizing the "literacy biographies" of her famous Americans.

Stephanie Johnson too is a first-grade teacher, and she has written a unit focused on three figures – Walt Disney, Helen Keller, and Dr. Seuss – of immediate interest to her students. Johnson will stress the creativity at the center of each of these three lives, and use it as a springboard for classroom activities that include drawing and animation, reading and writing (and with Dr. Seuss as a model, rhyming!), experiments in Braille, and creative use of online resources.

Biography lends itself, as Johnson's unit suggests, to experiments in various media. A life can never be reduced to a set of documents; to grasp it, we want pictures, moving images, objects, sound – media and materials that point beyond language to embodied experience. Deborah Monroy, in a classroom very different from Johnson's, also shows that biography lends itself to multi-modal learning and a holistic approach to knowledge. She

will use the form as a way to deepen her advanced high-school students' engagement with French history and culture and reflect on their own lives in response to print and online resources, film, and the graphic novel (students will produce their own bande-dessiné biographies collaboratively). At the same time, she will urge students to see themselves as having biographies themselves, and able to shape their own lives.

That's a goal shared by every unit here, but it is especially emphasized in some. Edina Buzgon, for instance, who teaches business marketing to high school students, will use biography to introduce her students to the exemplary lives of successful entrepreneurs in the US and in their particular community, in the hope that they too will see themselves as engaged in the long-term project of creating successful careers in business. Barbara Prillaman has designed a curriculum unit that explores the life of Cesar Chavez in order to introduce biography to her Spanish-speaking students, and to provide a positive role model for them, which she will build on by asking them to go into their community and create biographical profiles of Hispanic leaders. Stacia Parker's unit will use the life of Barack Obama to suggest to her predominantly African American high school students their own potential to shape a life that refuses to conform to the reduced expectations for their futures that may come with life in an inner-city community. To have a biography is to have a life that is actively chosen and unfolding over time, necessarily shaped, but not finally determined, by the social circumstances into which we are born.

While they too plan to use biography to enhance their students' sense of self-esteem and expand their view of their own prospects, Stephanie Brown-Bryant and Dean Whitbeck both highlight another ethical dimension entailed in the form. The focus in their differently designed units is on the obligation of the biographer: the demand on the biographer to be responsible to the facts and feelings of another person's life, and in that sense, to learn to relate to, and indeed to take care of, others. Brown-Bryant's unit is responding in particular to the ethical questions raised by young people's participation in online social networking and the effect on their imaginations of "reality" television. Whitbeck will use biography as a formal strategy by which his inner-city students can learn to shape and present in controlled and respectful ways the difficult and sometimes even traumatic stories of classmates, family members, and people from the surrounding community. Both of these units, Brown-Bryant's and Whitbeck's, will use peer-interviewing and digital technology.

Can a place have a biography? A town? A school? Yes, Mika Cade suggests, and her unit demonstrates how. Developing in rich ways the oral history techniques that other seminar Fellows will experiment with, Cade plans to have her students in the Bay Area town of Emeryville, California, learn about the history of their town by producing collaboratively a biography of their school. They will use school yearbooks in particular 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. Students will become

researchers and biographers, investigating the past as it reaches into the present moment in which they live.

Cade's English class highlights biography as a way to approach history, while Andrea Kulas, teaching AP English students in Chicago, is especially concerned with biography as a way to read literature. Having given her AP students an introduction to a variety of critical methods, or lenses, for reading literature, Kulas will add biography to this curriculum as a particularly accessible and "uniquely sensitive" interpretive tool. Her focus will be on teaching students to use biographical documents as evidence as they mount evidence-based arguments about Langston Hughes's poetry. At the same time, she will be teaching students to think about literature in historical context.

On the other side of the history/literature divide, Jeff Joyce's AP US history students will learn, as David McCullough suggests, the pleasure of the "great stories" as a way to enter into the lived complexity of history. The sheer scale of history makes it hard for students to approach. Biography is, in a sense, a form of micro-history: it makes large historical developments visible through the lens of one life story. But biography can itself be an unmanageably large form – think of the tomes devoted to a US President such as Lyndon B. Johnson. Joyce's practical answer to the problem of scale is to ask students to produce "Micro-Biographical Essays" (MBEs) of representative figures, focusing on a particular phase or event in the life as a way into larger historical structures.

Molly Myers, a history teacher who will team-teach a high-school course on women's history and literature with a colleague in English, has written a curriculum unit straddling both sides of the history/literature divide. Preparing students for a year-long biography assignment, in which they will research and write a biography of a woman whom they will interview, Myers has designed a "Biography Primer" centered on the fascinating case of Sylvia Plath. The "Primer" is intended to introduce students to the complexity and richness of biography as a form by investigating the controversies that surround Plath through exposure to biographical accounts of her life and work. They will learn to think about Plath in historical context, and to see how history takes shape in an individual life – in terms of the choices a particular woman makes, the constraints on those choices, and the competing ways in which her life may be interpreted.

Langdon L. Hammer

Synopses of the Curriculum Units

2010.03.01

[American Biographies: Lives Transformed by Literacy](#), by Holly Banning

This unit, "American Biographies: Lives Transformed by Literacy," was developed for my first grade class as a cross curricular unit, addressing standards of learning in both language arts and history. This unit provides a means for children to connect with historical figures from the past with an emphasis on literacy and its transformative effect on the lives of the people we study in history. It is designed to be implemented primarily in history and/or social science class, but elements of the unit can be utilized as either enrichment to, or a component of, first grade language arts instruction.

The unit is intended to be cross-cultural and inclusive; having the potential to be used in virtually any demographic. It is a six week unit focusing on the biographies of Frederick Douglass, George Washington, Abraham Lincoln, George Washington Carver, Benjamin Franklin, and Helen Keller. Although the unit was envisioned and created for first grade, it readily lends itself to be adapted in full or part for any grade level. The historical figures could be added to, subtracted from, or completely changed according to the state and local standards as needed.

(Developed for Language Arts and History, grade 1; recommended for Language Arts/English and History/Social Science, grades K-8, but adaptable to most any age range)

2010.03.02

[I Have a Story to Tell: Learning through Peer Biographical Inquiry](#), by Stephanie Brown-Bryant

Biography is seen in various technological and media representations. Social networking, Facebook, YouTube, video sharing websites, and reality television are just a few examples of how students see the lives of others daily. The goal of this unit is to help students learn how to use information about other people in a productive manner for personal growth. Students will examine a variety of biographical forms designed to promote interactivity with peers. Students will review the lives of notable persons and identify key characteristics and events that are relevant or important to them. The process allows students to engage in dialogue that encourages cultural discovery and elevates self-actualization. Topics such as cyberbullying and negative consequences of online publishing help students understand ethical issues during decision-making. Students use higher-order skills to gather information using oral history and interviewing techniques about a peer. The process concludes with a creative biographical presentation of the peer in digital media format as students learn more about themselves and each other. Basic

research, communication, and technological skills provide practice and teach students new methods to gather and share information.

(Developed for Technology Education, grade 12; recommended for Language Arts, Social Science, and Technology Education, grades 10-12)

2010.03.03

Discovering the Entrepreneur, by Edina Buzgon

This curriculum unit can be used for business, marketing, or social studies classes at the high school level. Students will understand what makes up a biography, how a job can turn into a career, what an entrepreneur is, and how to interview entrepreneurs in order to write their biography. By implementing the various activities in this unit, the students will gain insight on what education or training is needed in various careers. This will help them to decide which courses to take in high school and provide them with a direction to go once they graduate. They will explore both a famous, well-known entrepreneur and a local entrepreneur in our community. This will be a meaningful and memorable experience for the teens as they begin to create their own life story as they develop their career. The unit may inspire them to become a future business owner.

(Developed for Marketing, grades 9-12; recommended for Business, Marketing, and Social Studies, grades 9-12)

2010.03.04

Voices of Emery Secondary: An Oral History Project, by Mike Cade

This unit describes a high school community oral history project. Students first study the genre of biography and sub-genre of oral history through model texts. There is a heavy emphasis on literacy strategies that work well with ESL and special needs students. The second stage of the unit is to conduct an oral history of our high school. Students will interview different members of the school community both past and present, write their biographies, and create a final presentation. They will take on the active roles of researcher and biographer. By the end of the unit students will understand how oral history can both shape and tell a more complete story of our past and present. Specific skills addressed are narrative writing, questioning, interviewing, critical reading, and critical thinking. Although I've designed this curriculum for my 11th grade English class, it can easily be adapted for other grade levels and subject areas, particularly social studies.

(Developed for English, grade 11; recommended for English and Social Studies, grades 9-12)

2010.03.05

[Approaching Literacy: The Lives of Walt Disney, Helen Keller, and Dr. Seuss](#), by Stephanie Johnson

Biographies are an account of one's life. Biographies come from ancient Greeks. At first these types of writings were called "lives" and seen as being of historical origin. The biographies I have included are popular and historical in a sense. The popularity comes from the three choices Helen Keller, Theodor Seuss Geisel and Walt Disney. They are very popular people. The chronological details will be explored to account for how their interests evolved into great achievements. Each of these individuals contributed to the American culture through the enrichment of children's lives. I choose them because of my interest in children and wanted to find the answer why they choose to enrich children as I have. Their enrichments contributed to society. Walt for instance is animation and performance with his movies. Helen's is perseverance against physical and environmental disadvantages. This connects with urban students in general and the Pittsburgh Promise a program that gives students assistance with higher education if they complete elementary and high school in my school district. Theodor's is writing. His writing is special because of the rhythm and rhymes involved. This type of writing is seen in poet verses and is called tetrameters. His books helped children learn how to read. We will also explore flip book making, Braille signs and reading stories. This unit is a fun way to include biography in literacy.

(Developed for Reading, grade 1; recommended for Reading, grades 1-2)

2010.03.06

[Micro Biographical Essays: Students Helping Students Learn about American History](#), by Jeffrey Joyce

This unit will be for my Advanced Placement United States History classes. I will conduct the unit over the course of the last month of school as AP exams take place in early May but our school calendar continues until mid-June. It will be the final product for the year.

My proposal for this unit is to assist students in creating Micro-biographical essays (MBEs). I hope to accomplish two things: 1) Address the need to make lessons in history easily consumable as it seems to me that large volumes of history create a barrier to young people beginning to take an interest 2) Help students to learn the craft of the biographer- telling a tale of a bio-subject in history. I also want to give others a meaningful historical resource by posting our MBEs on a website that my students will construct.

These histories are not to be immense by high school or any other standard. They will follow in the direction of a recent phenomenon called the micro-history. But these will be

kind of like super micro histories but written as biographies. I would imagine at this point that they will be somewhere between 15 and 20 pages in length.

(Developed for AP U.S. History, grade 11; recommended for AP U.S. History, grade 11)

2010.03.07

Biography through the Use of Document-Based Questions, by Andrea Kulas

For the past two years, my AP English Literature and Composition class has reviewed a variety of literary approaches, including formalist, gender, psychological, and mythological, among others. While I have presented the concept of "authorship," I have not developed a unit focused solely on using biography as an approach to critical thinking. I feel it is an appropriate subject for my class, as a strategy for reading fiction, poetry, and drama. Biography is uniquely sensitive to a variety of literary devices: irony, point of view, symbol, tone. In addition, delving into one critical approach will help students understand that each individual's critique of a text is influenced by his/her personal limitations, exceptions, and expectations. Their application of this will be a four to seven paragraph synthesis essay based on a variety of documents that have been provided for them.

(Developed for AP English Literature and World Literature, grade 12; recommended for AP English Literature and World Literature, grades 11-12)

2010.03.08

Voices of France: Understanding the Power of Individual Voice through Biography, by Deborah Monroy

This unit gives a colorful twist to the study of French history and culture and is appropriate for intermediate- and advanced-level 11th and 12th grade students. Reading about famous figures has long been considered an interesting way to learn about a different culture and individuals who are prominent in that culture. In this unit, French students will study examples of graphic memoirs and biographies. They will divide into groups to read about the childhood of influential figures from French history and relate the figures to the periods in which they lived. Subsequently, the groups will write graphic biographies of the figures and present them to the class. In this way, a natural context is created for the use of written and oral French and the whole class can benefit from the knowledge amassed by each group. Students will see how pivotal moments change the courses of people's lives and how individual lives can become important voices in history. Finally, students will reflect on their own lives and the course that these may take.

(Developed for French IV, grades 11-12; recommended for Intermediate French IV-V, grades 11-12)

2010.03.09**Who is Sylvia Plath?—An Inquiry-Based Biography Primer, by Molly Myers**

Like the genre of biography itself, this unit attempts to bridge the gap between History and English. It can also be used in either of the disciplines separately and effectively. While my purposes for creating the unit were meant to prepare students for a year-long biography assignment, the unit itself can stand on its own as an exploration of the genre. This unit explores the material of biography, primary sources, as well as the problems and possibilities of interpreting that material. The poet Sylvia Plath is the focus of the unit since her life is rich in accessible primary source material and she is the subject of multiple, and often conflicting, biographies. Students will practice the art of biography by "doing" biography while at the same time analyzing the existing biographies (in text, film, and song). They will navigate the same letters and journal entries that the biographers wrestled with, make their own interpretations, and compare their arguments to those of the excerpts on similar periods from published biographies. Through this unit, students should gain the skills of making inferences, reading critically, organizing information, forming and defending an argument, and comparing their argument with others.

(Developed for Women's Studies, grades 11-12; recommended for U.S. History, American Literature, and Humanities, grades 10-12)

2010.03.10**Barack Obama: A Nonfiction Approach to Reading in the "Reel" World through Documentary, Political Images, and Speech, by Stacia Parker**

This curriculum unit can be used in English, United States History, and interdisciplinary African-American Literature classes. Students will read and respond to Barack Obama's biography and other nonfiction texts which include documentaries, photographs, and political speeches. Conducting interviews, recording oral histories, and writing biographical narratives comprise a significant portion of the activities to help students explore the lives of people that have overcome obstacles. Additionally, students are asked to examine their own lives and how they respond to challenges. Hopefully, students will discern that how they respond to challenges is a "pivotal moment" that can provide opportunity for great change in their journey to adulthood. Student biographies will be preserved in a digital story format posted to the school's Web site.

(Developed for English Literature, grade 10; recommended for English Composition, grades 10-12, and American History, grades 11-12)

2010.03.11

Contando Vidas/Telling Life Stories: The Biographies of Influential Hispanics in Our Community, by Barbara Prillaman

In this unit, students will become familiar with the genre of biography and how biographies are constructed, learning about the components necessary to "tell" a person's life story. This will be modeled by using a case study on the life of Cesar Chavez, a person who has many things in common with these Hispanic, middle-school English Language Learners (ELLs). In teams, these Hispanic youngsters will interview prominent community members and these members' additional personal and professional sources. Interviewing skills will be modeled and practiced before going out into the community to meet with their community members. Students will also be required to analyze various written documents about these people's lives. Then, they will synthesize the information from their interviews and written document evaluations and write a short biography about their selected person. This unit, although geared toward a particular group of students and community, could easily be adapted to fit the needs of many other groups/communities.

(Developed for English Language Arts for English Language Learners, grades 6-8; recommended for English Language Arts and Social Studies, grades 6-12)

2010.03.12

Connecting to Community: Biography and the Digital Age, by Dean Whitbeck

This semester-long unit plan is divided into four modules (*Writing, Oral, Digital, Portfolio*) and is intended to teach biography as a form of literature and as way for students to explore stories in the their own family and community. The unit is directed toward high school students who live in a culture of inner-city poverty, but because environmental trauma and the pain of adolescence has no boundaries, the unit can be adapted according to grade level and learning environment. The extended study of biography offers students the opportunity to explore what it means to tell another's story and the empowerment that comes from offering that story to world. Students will read Art Spiegelman's graphic novel *MAUS* – a biographical account of his parents' experiences as Jews in concentration camps during the Holocaust. The hope is that in reading *MAUS* students can begin to dissociate from the trauma of their own community and become aware that telling another's story can validate their own narratives that are often never told.

The unit of biography also focuses on bringing twenty-first century technology into the art of storytelling. Students will create digitized oral and visual biographies that will be archived. The process of creating digital stories not only develops new literacy skills, it engages students in both a visual and aural experience. The final module of the unit is a portfolio in which students will present their work to the public for assessment and affirmation.

(Developed for Introduction to Literature, grade 10, and Creative Writing, grade 12;
recommended for Literature Courses, Middle School grades)

IV. The Mathematics of Wallpaper

Introduction

The idea of symmetry, which has long been associated with art and notions of beauty, took on a new life in the 19th century, when it was found to be the key to understanding deep questions left over from classical mathematics. In the 20th century, these same ideas were found also to be fundamental for understanding the behavior of matter. In particular, the hydrogen atom, the simplest particle of normal matter, was shown to have an intricate structure entirely determined by its symmetry. This seminar approached the idea of symmetry through its appearance in decorative patterns, especially wallpaper.

The mathematical conception of symmetry differs from the usual description of symmetry in art, where it usually is described in terms of "balance" and "harmony," words that connote stasis. For a mathematician, symmetry is an active idea – it involves transformations. An object (or a design or a figure, or any sort of structure) is called symmetric with respect to a given transformation, if that transformation leaves the key features of the object unchanged. The transformation is then called a symmetry of the object. For example, take a square. It looks the same if you reflect it in either of its diagonals, or in either line that connects the midpoints of two opposite sides, or if you rotate it through 90° in either direction, or by 180° . It is also unchanged if you do nothing. (The transformation that doesn't do anything – that leaves every point, or part, just as it was – is often not thought of as a transformation, but it is, and it plays a very important role, like 0 for addition, or 1 for multiplication.) This gives four reflections and four rotations, eight transformations in all, and these transformations, taken as a collection, constitute the symmetries of the square.

The importance of thinking of symmetry actively, in terms of transformations, is that transformations can be combined, by performing one and then performing another. The technical term for this is composition. For example, if you reflect a square in a diagonal, and then reflect it in a line through the midpoints of two opposite sides, the combined transformation, or composition, is a rotation by 90° . Thus, the rotations of the square are already inherent in the family of reflections of the square.

The possibility of composing transformations endows the collection of symmetries of a system with an algebraic structure, analogous to addition or multiplication, but with much richer possibilities. The technical term for a collection of transformations that contains the result of composing any pair of its members is group. The algebraic structure then has implications for the physical structure. For example, as described above, the square has 4 reflections, and 4 rotations (counting the identity – rotation through 0°). The fact that the number of rotations is equal to the number of reflections can be predicted by knowing the structure of the group of symmetries.

The seminar studied these ideas in the context of understanding the symmetries of planar figures or designs, in particular, regular polygons, frieze or strip patterns, and wallpaper patterns. We learned the four main types of isometry of the plane (reflections, rotations, translations, and glide reflections). We saw how these transformations could be combined into systems of symmetries of figures. Finally, we got some insight into how knowing the properties of transformations and how they combine allows one to classify the possible types of symmetry of patterns. For example, there are 7 essentially different types of symmetry that a frieze pattern can have, and 17 types for wallpaper. We also studied particularly elegant ways of constructing patterns with certain types of symmetry.

Each Fellow has selected from the broad array of topics touched on in the seminar to fashion a unit. Carol Boynton and Jane Fraser want to introduce their students to the geometric features of each of the main types of isometry. Shamsu Absul-Aziz and Katherine Radcliff will teach that the standard terminology for special types of quadrilaterals is in effect a symmetry classification of these figures. Several Fellows, including Elwanda Butler, Stephanie Colombo, and Rose Schmitt have designed projects that feature the seven types of frieze patterns. Finally, Holly Grandfield is emphasizing the geometric interpretation of the operations of arithmetic, using the number line. Each Fellow has selected and described an interesting feature of the elephant of an idea called symmetry.

Roger E. Howe

Synopses of the Curriculum Units

2010.04.01

[Geometry and the Real World](#), by Shamsu Abdul-Aziz

This unit "Geometry and the Real World" is a unit that is designed for sixth- and seventh-graders to teach them how geometry can be seen in the world around us through the concept of isometry and symmetry. This unit can also be used to teach eighth graders as well. It will be taught over approximately two weeks for 90 minutes each day. Instruction will be given to students in a whole- and small-group setting. Students will also receive hands-on mathematics experience that will help them apply what they learn to their everyday scenarios. Students will learn and apply a lot of symmetry and isometry concepts through classroom group exercise and projects. At the end of the unit, students will be able to create and identify symmetries and isometries in wallpaper designs, buildings, and nature. Not only will the students be able to create wallpaper designs that contain symmetries and isometries, they will be able to explain their knowledge of the isometries and symmetries that exist within them. This unit will help them see how the concepts of symmetry and isometry can be easily related to the environment in which they live.

(Developed for Mathematics and Geometry, grade 7; recommended for Mathematics and Geometry, grades 6-8)

2010.04.02

[Repeat After Me!](#), by Carol Boynton

We live in a world of patterns. They are all around us in everyday life, something that my first grade students notice and comment on quite frequently. When they recognize a pattern, or at least a perceived pattern by their definition, they become excited for successfully noticing a repeating motif or design.

The goal of this unit is to deepen students' understanding of how patterns work through manipulation of different materials and across the curriculum – art, music, literacy, and science. It is intended to provide experiences for first grade students to learn about and understand patterns through exploration and discovery. Young students observe and experience the world sensorially. From this experience the child abstracts concepts and qualities of things in the environment.

First graders are expected to be able to successfully sort, classify, and order objects by size, number, and other properties; recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another; and analyze how both repeating and growing patterns are generated. With these focal points in mind, I would like to use the big idea of symmetry

and wallpaper designs to guide my students through a more exciting, meaningful introduction to geometry and patterns.

(Developed for Math, grade 1; recommended for Math, grade 1)

2010.04.03

Putting the Pieces Together, by Elwanda Butler

Putting the Pieces Together is a unit designed to teach third graders about the mathematical concept of symmetry. This unit can be adapted for other grade levels as well. Students get the opportunity to learn about symmetry through a five week unit. Two or three lessons are presented each week. Instruction will be given in whole and small group settings. Students work in cooperative groups, pairs, and on their own. Each lesson takes about 45 minutes to complete. Students receive a hands-on math experience. I integrate math with language arts and art. For the language arts component, I read math related picture books. Students discuss these books and apply the information to the math lessons. Art is immersed throughout the unit; students create a lot of different symmetrical designs and projects. At the end of the unit, students will be able to identify lines of symmetry found in different objects. They will be able to tell the difference between the types of symmetry on frieze patterns, such as rotations, reflections, and glides. Students will be able to effectively communicate their knowledge of symmetry to others. Students learn how symmetry is all around us in nature, architecture, and art.

(Developed for Math and Symmetry, grade 3; recommended for Math and Symmetry, grades 2-5)

2010.04.04

The Art of Symmetry, by Stephanie Colombo

The Art of Symmetry is an exploration into the basics of Geometry, how shapes and images move on a grid, and how this connects to symmetry of patterns. It is designed for any teacher looking to introduce symmetry to their math classes. This is a unit that can easily be adapted for any level of math or art classes. Lesson plans will include a variety of differentiated instructional strategies including games, symmetry in everyday life, art and lecture. All lesson plans are based on a direct instruction model which scaffolds each skill into small increments. Students will be introduced to symmetry through pictures of famous structures in the Bay Area. Afterwards we will make a day and explore symmetry in games such as building a house of cards to better understand the concept with a hands on activity. Lectures on the basic idea of symmetry and the 7 Frieze Patterns will further their understanding of symmetry and how simple shapes and figures move within a grid and later onto wallpaper. Their final project will be both identifying each of the 7 Frieze Patterns by looking at simple wallpapers and creating wallpaper designs of their own by choosing any 3 of the 7 Frieze Patterns.

(Developed for The Essentials of Algebra, grades 9-12; recommended for Basic Geometry and Special Education Math Class, grades 3-12 with the higher grades more for special education classes)

2010.04.05

[Beyond the Wumps: Exploring Symmetry in Seventh Grade](#), by Jane Fraser

Symmetry is everywhere. It is in nature, in buildings, in the tiniest building blocks of the human body. We are naturally drawn to symmetry. The 13-year-olds I teach are surrounded by symmetry, even if they are not aware of it: the McDonalds' arches, the logo on their t-shirt, the rhythm of their favorite song. And while they know more about symmetry than they realize, they really don't know much about the mathematics involved.

This unit will cover the basics of transformational symmetry and take the students beyond what they have learned up to this point about similarity and congruence. They will learn about the idea of *isometry*, a transformation that preserves distance. The ultimate goal is to have them make patterns by moving a single figure around on the coordinate plane, and finally creating a frieze pattern of their own design.

This unit is intended for a seventh-grade classroom. It is a basic, fairly simplified review of transformational symmetry on the middle school level.

(Developed for CMP2 Mathematics, grade 7; recommended for CMP2 Mathematics, grade 7)

2010.04.06

[The Power of the Number Line: Building the Bridge from Mathematics to Symmetry](#), by Holly Grandfield

This unit is designed to teach the foundational mathematics needed to understand the math students' encounter in middle school, high school and beyond. It is written for students in fourth grade; however, it could be taught to younger or older children depending on their needs. I believe the number line may be underutilized in the elementary classroom beyond teaching simple counting in the early primary grades. However, teaching students to understand how movement on the number line is a transformation can lay a strong foundation for the math that is to come in later years. The primary focus of this unit is to provide students with another model for understanding multiplication, namely the number line as a geometric interpretation of multiplication. This unit was developed from a seminar on symmetry because there exists a deep connection between symmetry and mathematics: doing one thing and then another to a geometric shape is a mathematical operation. The goal of this unit is to help students think of "number" as an adjective, no longer as a noun. It is the uniform stretching of

intervals on the number line that provide the structure for understanding multiplication, and addition and subtraction as well.

(Developed for Mathematics, grade 4; recommended for Mathematics, grades 4-5)

2010.04.07

Patterns, a Different Point of View, by Luis Magallanes

Being able to combine music and dancing in combination with the application of math concepts entices me to create a unit that would engage all students in my math classes. This unique way to present math, opens up a door for a different and innovating style of teaching mathematics. Math will not be any more a "secret" knowledge that only some students can access. Math will be accessible by all means to anybody that would try to learn. That is the intent of this curriculum unit; to provide a friendly environment for all students.

The relationship between *staff* in music and a *coordinate system* in Algebra and in Trigonometry provides the perfect field in which, we can describe geometric translations for music and for Algebra. Translations in music are called ***transposition*** and ***time delay***, while in math they are called ***vertical*** and ***horizontal translations***.

The unit also provides information on how to work with reflections over the lines $y = x$ and $y = -x$ and their use in graphing inverse functions. Reflections and rotations, and the symmetries of the square, are as well described as patterns used for dancing. All of these ideas will help to get students interested in math.

(Developed for Algebra II and Trigonometry, grades 10-12; recommended for Algebra II, grades 9-12, and Trigonometry and Pre-Calculus, grades 10-12)

2010.04.08

Making Connections in Symmetry, by Katherine Radcliff

Being able to combine music and dancing in combination with the application of math concepts entices me to create a unit that would engage all students in my math classes. This unique way to present math, opens up a door for a different and innovating style of teaching mathematics. Math will not be any more a "secret" knowledge that only some students can access. Math will be accessible by all means to anybody that would try to learn. That is the intent of this curriculum unit; to provide a friendly environment for all students.

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(Developed for Algebra II and Trigonometry, grades 10-12; recommended for Algebra II, grades 9-12, and Trigonometry and Pre-Calculus, grades 10-12)

2010.04.09

Math and Design, by Rosemary Schmitt

If you are looking for a way to incorporate symmetry into your curriculum, and math into art class, then this unit may provide the opportunity you are looking for. This unit is designed for middle school students, preferably eighth grade. It focuses on symmetry and the transformations of designs. It starts with introducing symmetry including the transformation of reflection, rotation, translation and the less well-known transformation of glide reflection. We will also take a look at frieze patterns (a repeating decorative pattern commonly seen around the tops of older buildings) and try creating our own geometric pattern.

Students will be able to recognize and describe symmetries of designs by finding center of rotation and axes of symmetry. Then they will make their own design with one or more specified symmetries. They will be expected to perform reflections, translations, and rotations to create a frieze pattern of their own. They will incorporate their frieze pattern into an art project where they will look at art work by Shepard Fairey (a contemporary artist) and use him as inspiration for their own art piece. This unit contains the most important concepts stressed in transformation and symmetries for an eighth grade class.

(Developed for Pre-Algebra, grade 8; recommended for Pre-Algebra, grade 8)

V. Nanotechnology and Human Health

Introduction

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 ultrasmall 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.

Specifically, the seminar covered the following topics:

1. Size and Scale
2. Structure of Matter
3. Forces and Interactions
4. Self-assembly
5. Size-dependent Properties
6. Medical Applications of Nanotechnology
7. Tools and Instrumentation
8. Scanning Electron Microscopy
9. Science, Technology, and Society

The discussions were enhanced by our reading from three books: *Why Size Matters*, John Tyler Bonner, Princeton University Press (2006); *Soft Machines*, Richard A.L. Jones,

Oxford University Press (2004); *Big Ideas of Nanoscale Science and Engineering*, Shawn Y. Stevens, LeeAnn M. Sutherland, Joseph S. Krajcik, NSTA Press (2009).

The Fellows prepared curriculum units that covered a breadth of information on nanotechnology. The material presented in the units assembled in this volume span an impressive range and are designed for use in classrooms from upper elementary (fifth grade) through high school.

Most of the units focused on material that is appropriate for high school students. Eric Laursen prepared a unit called "Nanotechnology and Quantum Mechanics: Bringing High School Physics into the 21st Century," which is designed for use in high school physics classrooms. The unit provides an introduction to some of the key concepts of quantum mechanics, in the context of nanotechnology. 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 discusses the influence of size on function. It also discusses biotechnology, which depends on biological machines that are nanometer-sized. Mary Whalen prepared a unit called "Health and the Invisible World," which discusses viruses, nanometer-sized biological objects that can cause disease. Ram Bhagat prepared a unit called "Nanotechnology and Clean Water: How Safe Is Our Drinking Water?" This unit describes the challenge for consumers of identifying the best sources of clean water, and the range of nanotechnologies that can now be used to purify water. 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 from nanotechnology to help introduce essential math topics of high school students, including scientific notation and exponents.

Two of the units are addressed to middle school classrooms. Sharon Mott prepared a unit called "The Size of Matter: Why Properties Change at the Nanoscale." This unit describes how the effects of physical forces can differ for small objects, and relates these changes to the chemical structures of the nanomaterials. Stephen Griffith contributed a unit called "Teeny Tiny Wonders: Nanotechnology and Machines." This unit concentrates on the physics of small objects and the use of nanotechnology for making consumer and medical products.

Finally, one unit is addressed to elementary school classrooms. Doriell Moorman contributed a unit called "Nanotechnology for Enhancing Math, Science, and Language Arts in the Elementary Grades: How Small Is Your Future?" This unit introduces the concepts of nanotechnology to fifth-grade students, providing an introduction to the structure of matter and how this can be manipulated to create nanotechnologies.

W. Mark Saltzman

Synopses of the Curriculum Units

2010.05.01

[The Relative Nature of Size in Biological Sciences: Let's Start Small and Work Our Way Up](#), by Conchita Austin

Nanotechnology is a big word that is used to describe a science which deals with things that are really, really small. The applications for nanotechnology, also referred to as nanoscience, are numerous and far-reaching. Research is currently being conducted in areas as diverse as cancer treatments, self-cleaning windows and toilets, water purification, and cosmetics. In this unit, I want to first introduce to my students a concrete concept of size scaling and how size relates to the structure and function of living organisms. Next, I will like to explore the science of nanotechnology and the various applications that are available today as well as the potential for future applications.

In this unit, students will first be introduced to metric measurement and the concept of size relativity in order to understand the nanoscale. Next, students will explore how living organisms are dependant on scaling for structure and function. The students will then apply what they have learned by constructing their own creature and explain how size and scaling dictated the form of their creation. Lastly, students will view nanotechnology as a part of biotechnology and discuss the practical applications that have already been developed and the growing potential of nanoscience for the future.

Upon the completion of this unit, I want my students to be able to recognize these concepts and be able to apply this knowledge effectively as we discuss the structure, function, adaptation, evolution, and interconnectedness of all living organisms in our biosphere throughout the entire course. As a result of teaching this unit, I want to be able to introduce some of the models and concepts which will not only enhance what we will be covering in this course this semester, but will form background knowledge for the courses my students will take after Biology such as Chemistry, Physics, Physical Science, and Anatomy.

(Developed for Honors Biology, General Biology, and SIOP English as a Second Language, grades 9-12; recommended for Biology, grades 9-12, and Life Sciences, Middle School grades)

2010.05.02

[Nanotechnology and Clean Water: How Safe Is Our Drinking Water?](#), by Ram Bhagat

This is an inquiry-based unit designed to guide students in the development of pertinent questions about direct (*i.e. personal*) concerns of water quality, as well as indirect (*i.e. global*) concerns about water quality.

After energy, the second major problem facing global society is the availability of clean water. To address this concern, intelligently and cooperatively, members of society must be well informed. Presenting students with a conceptual framework to help them understand size and scale, the basic functions of atoms and molecules, and some emerging applications of nanotechnology will provide them with essential knowledge.

Access to clean water is a bigger problem for exploited and under industrialized areas than hunger. Within the next two decades, the average supply of water per person will drop by one third, possibly condemning millions of people to severe dehydration and avoidable premature death. The design and manipulation of atomic and molecular scale (*nanoscale*) materials offers great possibilities for advances in cleaner energy production and water treatment.

One of the primary reasons for teaching this unit is to foster a basic understanding of nanotechnology and its applications in the field of chemistry, as it relates to water pollution and purification. I contend it is essential to facilitate a learning experience that empowers students to analyze the relative quality of drinking water in their community.

The crux of my unit is to integrate the performing arts (*i.e. drumming, dance, and drama*) into science, an approach I refer to as 3D Aesthetic Science Education (*ASE*). This approach to science education through the arts is designed to expand the students' understanding of scientific concepts and principles through interpretive performance based activities.

(Developed for Chemistry/Atomic Structure, grades 10-11, and AP Environmental Science, grades 11-12; recommended for Chemistry/Water Chemistry/Pollution, grades 10-11, Environmental Science, grades 9-10, and AP Environmental Science, grades 11-12)

2010.05.03

[Teeny Tiny Wonders: Nanotechnology and Machines](#), by Stephen Griffith

Nanotechnology is a wondrous new realm of science that deals with extremely small objects. These particles are so small it is hard for humans to comprehend them. Being that this is a new realm of science it is important and imperative that students have an opportunity to find out about this field as it is quickly becoming a part of our everyday world with many products already released using nanotechnology. Although this field of science is exciting and expanding rapidly there are few references to nanotechnology in current middle school science textbooks thus making the creation of this unit plan an important resource in teaching some basic concepts about nanoscale and nanotechnology. In order to better acquaint oneself with nanotechnology it is important to understand how many of the ideas of physics change as the size of the objects also change. This unit will look at some of the main areas of nanotechnology including: size and shape, strength vs.

weight, effects of gravity, motion of these objects, chemical make-up. It will take these main concepts to look at a few of the areas where nanotechnology is currently being used, and where it might be used in the future.

(Developed for Physical Science, grade 8; recommended for Physical Science, grade 8, Biological Science, grade 7, and Physics, grades 10-11)

2010.05.04

[Nanotechnology and Quantum Mechanics: Bringing High School Physics into the 21st](#), by Eric Laurenson

We are well into the 21st century, and yet, remarkably, in high school physics classes we only teach material that was developed by the end of the 19th century! How can this be true when physics underlies all scientific disciplines? There may be many answers, but a simple answer is that Newtonian mechanics, when dealing with physics on the human scale (the macroscopic world), is considered close enough! As a conceptual and theoretically minded person I don't think that this answer is adequate; we KNOW from modern physics that the world is different than we are used to encountering. However, on large scales the "weird" consequences of quantum mechanics (which indicates that energy is not continuous but instead comes in small "packets" known as quanta and that reality is really probabilistic instead of deterministic) are averaged out and, therefore, undetectable. However, at the nanometer (10^{-9} meters) –scale, quantum mechanics cannot be ignored and in fact begins to dominate. Nanotechnology literally opens up a world of possibility in that it offers an opportunity to give a tangible explanation and use for quantum mechanics.

(Developed for PSP Scholars Physics I and CAS Gifted Physics, I, grades 11-12, and APB Physics II, grade 12; recommended for Physics I and II, grades 11-12)

2010.05.05

[Nanotechnology for Enhancing Math, Science, and Language Arts in the Elementary Grades: How Small Is Your Future?](#), by Doriel Moorman

Nanoscience is the study of matter at the molecular scale and takes us into a scientific arena where the properties of matter are different from the macroworld in which we live. It demands new tools, new understandings, and may be the beginning of a new technological revolution. This unit introduces elementary students to the world of nanotechnology. It provides them with an overview of what nanotechnology is, how it is used, and how it will impact our future. This unit provides students with a basic understanding of the structure of matter, how scientists are able to study and manipulate nanoparticles, and the role that nature plays in this emerging science. It was written to make integration into a math and/or language arts curriculum program relatively easy without sacrificing the content that is required to be covered. It is an engaging and

interactive unit with the goal of enticing students to develop an interest in science in general and nanoscience in particular. The four key factors presented for students to keep in mind as they explore the nanoworld are: all matter is made of atoms, atoms are in constant motion, molecules have size and shape, and molecules arranged into nano-objects have unexpected properties.

(Developed for Elementary Math Enrichment and Elementary Language Arts Enrichment, grade 5; recommended for Math, Science, and Language Arts, grade 5 and adaptable for grades 2-4)

2010.05.06

[The Size of Matter: Why Properties Change at the Nanoscale](#), by Sharon Mott

Size is a factor that affects all aspects of our lives. The behavior of objects can change dramatically as size decreases. This unit will help students discover how size affects the functions, behaviors, and properties of matter. Students will learn the relationship between absolute and relative size at different scales. The unit will review forces that act upon atoms and molecules and how these forces affect materials of different size. The focus of the unit is atomic structure and forces as they relate to size, size and scale, and size dependent properties. The unit will provide students an opportunity to use scientific notation and the powers of ten to express specific measurements at varying scales, as they conduct in depth explorations on size and properties of matter. The culminating activity is a cross curriculum reading assignment that requires students to examine whether information in their stories are fact or fiction based on their knowledge of size and matter.

(Developed for Physical Science, Chemical and Physical Properties of Matter, grade 8; recommended for Physical Science, Middle and High School grades 8 and 10)

2010.05.07

[If You Can See It, It's Not Nano: Working with Numbers at the Extremes](#), by Nancy Rudolph

Using the field of Nanotechnology as a backdrop for the semester, 10th - 12th grade math students will learn the mathematics related to this emerging field. Within the context of Nanotechnology there are several areas of overlap where science and mathematics support each other; this unit will naturally integrate the two subjects to benefit student understanding. Students will begin the semester with an overview of science at the nanoscale (materials having at least one critical dimension between 1-100 billionth of a meter) including *intramolecular* and *intermolecular* bonding characteristics of atoms, properties of matter, and applications of Nanotechnology relevant to their lives. "Size and scale" is the unifying concept, in that students have minimal experience with materials smaller than what they can see. Students will describe absolute sizes using scientific notation, and study the significance of the increased surface area to volume ratio of

nanomaterials on physical properties. The mathematical topics in this unit address common areas of weakness: Number Sense (relative size); Exponents (applying properties, negative exponents); and Geometry, (composite area and volume, effects of scaling). More advanced topics for upper level math classes include Logarithms and the Fibonacci sequence.

(Developed for Pre-Calculus, grades 11-12, and Integrated Math III, grade 10; recommended for Math, Algebra, Geometry, and Pre-Calculus, grades 10-12)

2010.05.08

[Health and the Invisible World](#), by Mary Whalen

I have been concerned with the fact that many people misuse prescription drugs. This misuse is not just recreational; it is also misunderstanding of the nature of medications. For example, friends and relatives have offered me left over antibiotics when I complained of a sore throat. There are several problems here: they stopped their medication early, selecting for antibiotic resistant bacteria, and they are diagnosing my disease without any expertise.

Since some of the California standards for health address correct use of prescription drugs and since the California Department of Health has been reminding schools about the dangers of multiple resistant bacteria, I combine several topics and present a unit on the differences between bacteria and viruses. We explore the size and structure differences between bacteria and viruses and why antibiotics do not work on viruses. We also do activities to show how taking medications incorrectly actually selects for bacteria resistant to that medication. At the same time, we learn about communicable disease, both viral and bacterial.

In the end, I want students to take from these lessons an understanding of why taking their medications correctly is important. I also want them to glimpse the incredible complexity of microorganisms.

(Developed for Health, grade 9; recommended for Health, grade 9, and Biology, grades 9-10)

VI. Evolutionary Medicine

Introduction

Evolutionary biology involves studying genetic changes within populations over time, and resolving relatedness among species. Although evolution is central to the understanding of biology and the history of life on Earth, one problem with teaching evolutionary biology is that students often fail to grasp its applied significance. Evolutionary medicine is the application of evolutionary thinking to gain valuable insights and new perspectives into human health and disease, demonstrating that knowledge of evolution vitally impacts our everyday lives. The overall aim of this seminar was to explore ways to teach students about aspects of evolutionary medicine, emphasizing that this interdisciplinary science helps explain the origins of many medical conditions, including obesity, diabetes, asthma, heart disease, allergies and aging. Also, the seminar stressed that evolutionary medicine informs why humans often suffer from infectious diseases ranging from benign to deadly, and how illnesses such as smallpox, malaria, AIDS and the flu have profoundly influenced human evolution, societal interactions, and major historical events. The seminar incorporated instruction and discussions of readings on evolutionary medicine, some hands-on laboratory experiments, and a tour of the collections at the Peabody Museum of Natural History to learn how these holdings are used to study evolutionary biology. The seminar was intended for teachers of science and mathematics at all grade levels.

The resulting units were diverse, reflecting the varied interests and backgrounds of the Fellows. Vivienne Bartman-McClellan develops a unit for elementary school students that examines why popular sanitizers do not protect against all infections, and the idea that growing up in overly clean environments may actually increase disease susceptibility later in life. Intisar Hamidullah's unit looks at the historical impact of diseases during the Civil War, and how these illnesses led to high mortality in soldiers. Deborah James focuses on the mysterious and alarming increases in asthma and food allergies in children, and the possible roles of genes and the environment. Madeline Keleher's unit emphasizes the teaching of hypothesis-testing, where students are challenged to think about proximate and ultimate explanations for natural phenomena, especially evolution of systems in the human body. Laura Kessinger's unit is on nutritional choices and human health, emphasizing how humans evolved through time and that our current diets differ dramatically from those of our ancestors. Valerie Schwarz describes how human history has been affected by disease, particularly the arrival of Europeans and Africans in the New World and the devastating effects of diseases such as smallpox on Native Americans. Deborah Smithey's unit is on HIV and the AIDS epidemic, and could be used to help instruct teenage students about risky behavior and its dangerous consequences. Connie Wood's unit connects together teaching of evolutionary biology and the human body, to show students that diseases such as sickle-cell anemia have persisted in humans

because the responsible genes protect against dangerous pathogens such as malaria parasites.

Paul E. Turner

Synopses of the Curriculum Units

2010.06.01

[I Use Sanitizer; Why Do I Still Get Sick?](#), by Vivienne Bartman-McClellan

This unit is designed for an elementary classroom. With this obsession with sanitizer I wonder why the children are still getting sick. Even the children are asking questions pertaining to why they have a cold or flu when they use the sanitizer all of the time. The burning question is: what other factors may influence the spread of germs? From a very young age we have all been taught to cover our mouths when we sneeze or cough, wash our hands before we eat and after we go to the bathroom and to clean up after making a mess. But, with all of the hygienic precautions we take why are we still getting sick? The students need to make an informed decision about how to stay healthy by doing their own investigations and experiments. They will need to get an understanding that there are many possible reasons that they get sick and that sometimes being overly sanitized can cause adverse conditions. This unit will help them make better healthy choices through hands-on scientific activities.

(Developed for Science and Health, grade 2; recommended for Science and Health, grades K-5)

2010.06.02

[The Impact of Disease on the Civil War](#), by Intisar Hamidullah

This unit will focus on teaching middle school students about the impact of disease during the Civil War. When my students think about war they only envision video games, music videos, and movies. Teaching this unit will add to their vision and prior knowledge of war. I will impress upon students that the environment of the Civil War was filled with measles, syphilis, tuberculosis, smallpox and other diseases. During this unit students will connect the history of the Civil War with the history of the aforementioned diseases. We will explore the implications of how and why disease affected US history since the Civil War had the highest number of deaths from disease and not bullets. Exploration of the diseases will take place by traveling throughout the Civil War and discussing the relationships between the historical events that occurred. Simultaneously we will study how the diseases affected the soldiers' mortality before, during and after the war. Lastly students will be able to connect their history of diseases to how society deals with the diseases today.

(Developed for Special Education, Social Studies, Science, and Language Arts, grades 7-8; recommended for Middle School Special Education, Social Studies, Math, Science, and Language Arts, grades 7-8)

2010.06.03

The Human Impact on the Environment and the Effects on Asthma and Allergies, by Deborah Johnson

The purpose of this curriculum unit is to inform teachers of health and sciences about the increase of students with asthma and allergies over the years, particularly food allergies. May is asthma awareness month; therefore this curriculum unit investigates if humans contribute to this growing problem by looking at what scientists currently theorize are the causes for this increase of allergy and asthma sufferers.

This curriculum unit gives background information on the theories of why more people are developing allergies and asthma. Genes have a lot to do with this, as well as environmental factors — whether it is increased levels of air pollution, or global warming which increases the length of the growing season and pollen in the air. Others theorize that Americans are living in a "super-clean" environment not giving our immune system what it needs to develop the way it has over centuries through evolution.

Sample lessons include teaching students what asthma is and what we can do to decrease the risks of an asthmatic attack. The unit is designed to have students that do not suffer from asthma be more sympathetic to the asthma sufferer and be more aware of what to look for in case there is an emergency. The unit is also intended to help a student who is asthmatic know what to do if an attack occurs. New legislation is being looked into to enable asthmatic students to keep their inhalers with them rather than in the nurse's office.

(Developed for Biology and Human Health, grades 5-8 and 6-targeted; recommended for Biology and Human Health, grades 5-8)

2010.06.04

Human Health: Correlation, Causation, and Evolution, by Madeline Keleher

The aim of this unit is to teach students how to develop and analyze questions and hypotheses through the lens of evolutionary medicine. More specifically, the skills I want students to have at the end of this unit are the ability to: formulate testable questions, generate proximate and ultimate explanations for phenomena, and draw conclusions from data. The main concepts my students will understand by the end of the unit are that: evolution does not have a direction or plan, our bodies are a result of evolutionary compromises, there are both proximate and ultimate explanations to every human health issue, and correlation does not equal causation.

Evolutionary medicine is a perfect framework for teaching these skills, as it has a useful body of readily available data, and yet still has so many unanswered questions. Using evolutionary medicine will also be helpful because it is a field of science that students

can relate to. As the intersection of evolutionary biology and human health, evolutionary medicine will allow students to ask questions about their bodies, their ancestors, and what it means to be human.

(Developed for Health, grade 10; recommended for Biology and Health, High School grades)

2010.06.05

Nutritional Adaptations and Nutritional Choices, by Laura Kessinger

Students will be introduced to the effects of nutritional choices on their personal health. We will look at the evolution of human food habits, preservation and their effect on human health.

This unit is meant to immediately follow a basic curriculum unit on evolution that covers the basics of inherited traits, mutation, variation, and basic evolutionary biology.

Students will begin on a journey of human evolution. Looking to the past to describe and sketch the physical and mental changes that occurred from *Ardipithecus ramidus* to modern human. Students will utilize their imaginations and provided fossil evidence to track the changes and notate what makes humans unique. After which students will embrace the dietary habitual changes that happened when some men made steps from a hunter gatherer society to an agricultural based society. Students will begin by tracking their own eating habits and analyzing their chances of being impacted by a nutritionally reliant disease. Students will utilize case studies to determine gene transmission of specific dominant and recessive disease mutations as well as personal and environmental choices that led to diseases. They will create their own preservation laboratory and study the effects of additives, drying, and canning on foods.

(Developed for Science, grade 7; recommended for Science, middle school grades)

2010.06.06

Teaching Principles of Evolutionary Medicine through a Historical Lens, by Valerie Schwarz

Infectious disease impacted history countless times, but perhaps none more significantly than the decimation of Native Peoples in the Americas. This unit is designed to teach principles of evolutionary medicine by examining the three cultures that met in early America: English, Africans and Native Americans. The unit will delve into the principles of immunity, population size, and invasive and native species and biodiversity. A variety of strategies and activities will be implemented to teach high-level concepts in a developmentally appropriate manner. The overall goal of this unit is for my fourth

graders to understand and apply these principles to history, ecosystems and the world around them. This unit could be adapted for grades 5-8 as well.

(Developed for Social Studies and Science, grade 4; recommended for Science and Social Studies, grade 4, and adaptable for grades 5-8)

2010.06.07

[AIDS in The Teenage Community](#), by Deborah Smithey

The curriculum unit is for students taking a 1st year biology course in high school. The unit is a supplement when teaching about viruses and bacteria. The unit will provide students with background information about HIV and Bubonic Plague. It will provide them with the basic structure of a virus and the types of bacteria. The unit discusses the evolutionary relationship that exists between these two pathogens and the impact they have on society. Students will learn about the timeline for the HIV virus, correlations will be made to deaths found prior to the official timeline. The unit will expose the students to pathogens discussed in literature and sung in nursery rhymes. The purpose of the unit is to increase awareness in risky behavior and cause teenagers to alter this behavior. The unit will empower teenagers with knowledge about the dangerous HIV pathogens and how they can alter the spread of the pathogen in their community.

(Developed for General Biology and Science, grade 10; recommended for Biology, Science, Health, and Physical Education, grades 9-12)

2010.06.08

[Survival of the Fittest?—Evolution and Human Health](#), by Connie Wood

Biology teachers are asked to teach a huge amount of material in a very short time. The only way to accomplish this is to integrate topics into one unit. With this two week unit, I will be using evolution to help students understand how their bodies work and why they sometimes don't seem to work so well. By bringing in some of the ideas about evolutionary medicine, I will help my students see that evolution is not just about the past, but is happening all around us, and affects our everyday lives.

I begin with an introduction to natural selection and how it causes changes in populations. I include activities that explore the evolution and effects of sickle cell anemia and the disease's connection to malaria. Students will observe normal and sickle-shaped red blood cells and investigate the effect of blood cell shape on the function of the circulatory system using models to help them visualize how the shape of the cells leads to the symptoms of sickle cell anemia. Other systems will be described in terms of their evolutionary adaptations and examples of genetic disorders of those systems which have persisted in populations in spite of their costs to the individual.

(Developed for Biology I, grade 10; MYP Biology I, grade 9; recommended for Biology I, grades 9-10)